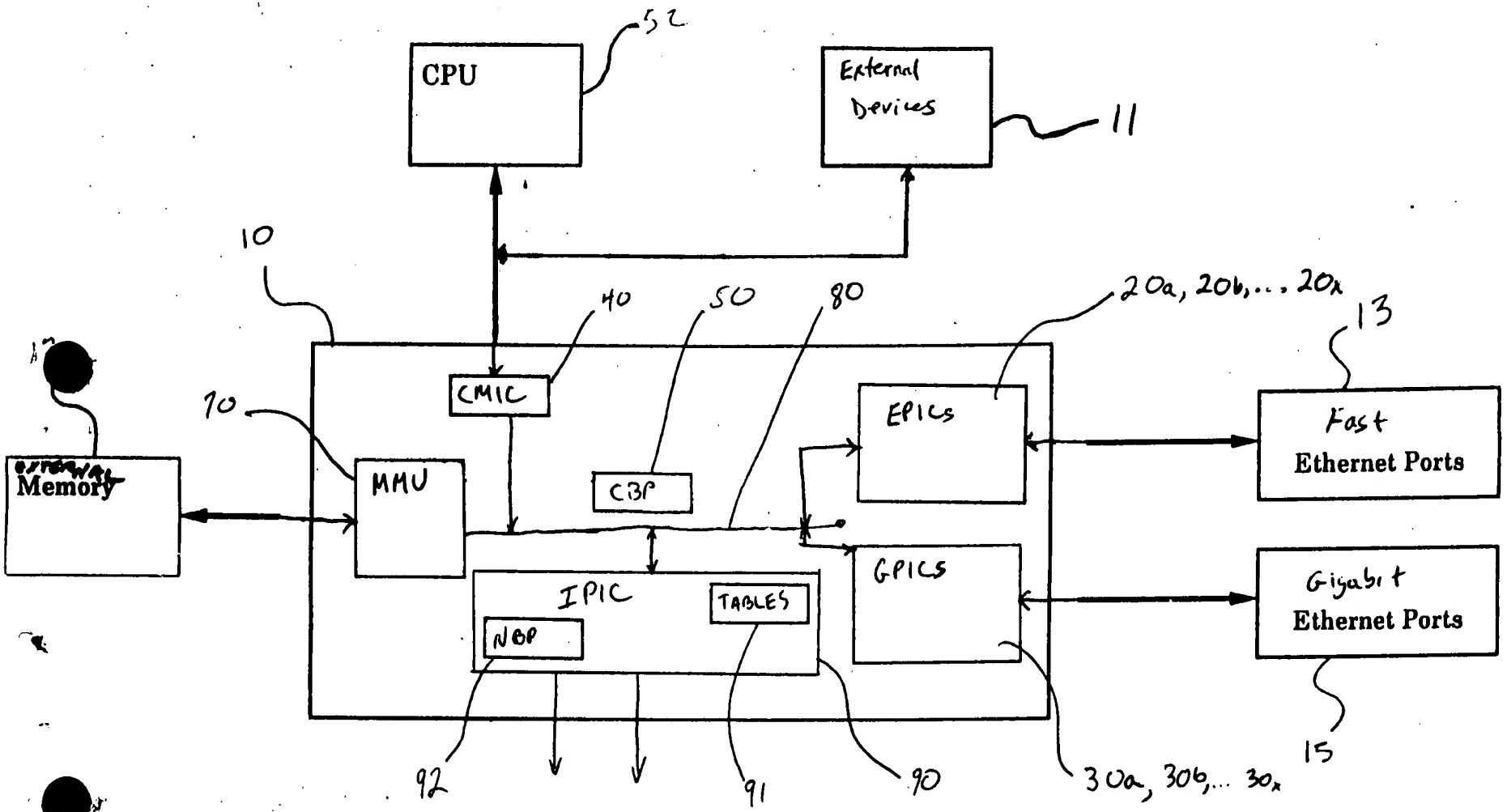


Fig. 1

09527999.031700

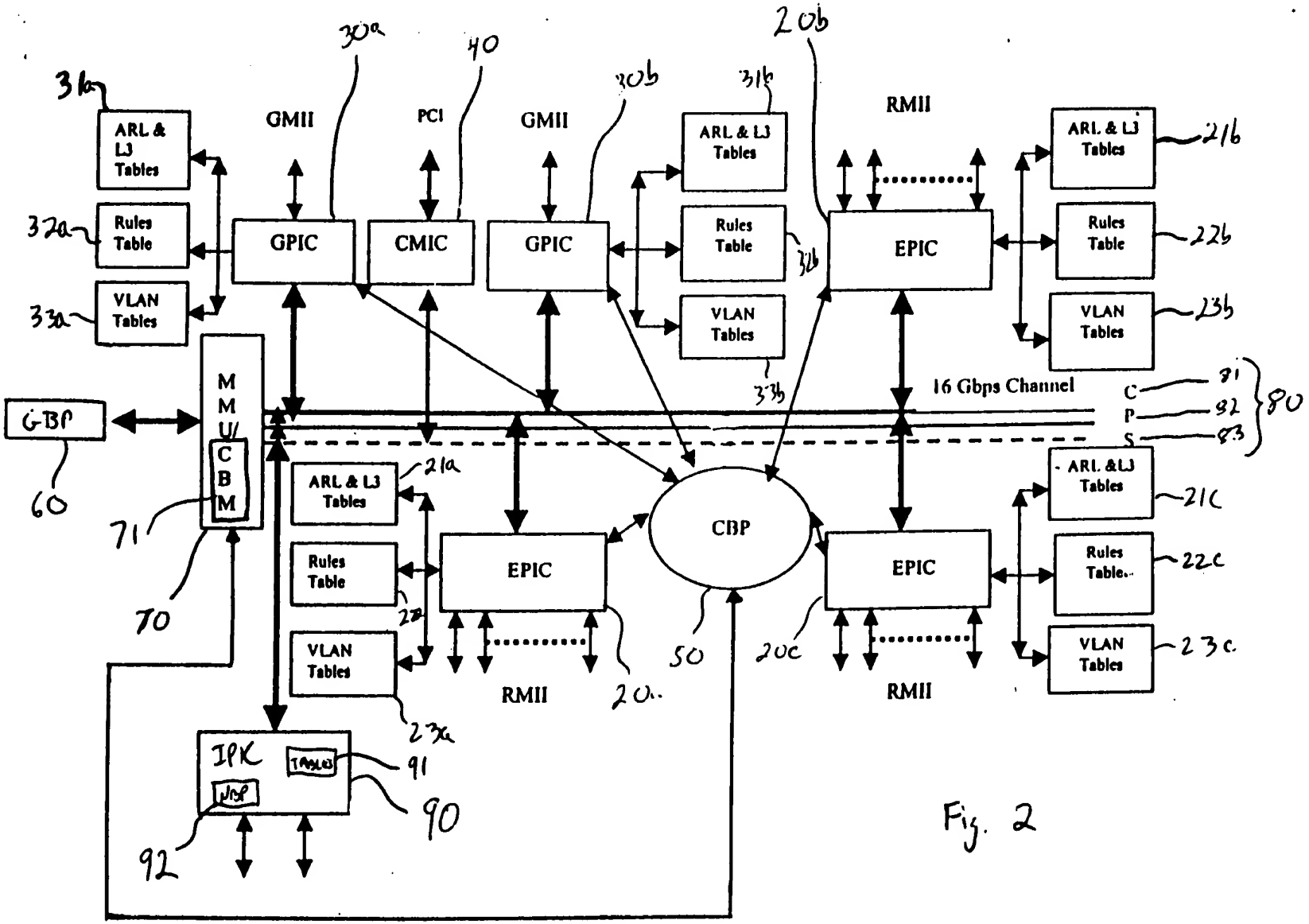

ARL & L3 Tables
Rules Table
VLAN Tables
GMII
PCI
GMII
GPIC
CMIC
GPIC
RMII
EPIC
16 Gbps Channel
C
P
S
MMU
CBM
GBP
CBP
IPK
RMII
RMII

Fig. 2

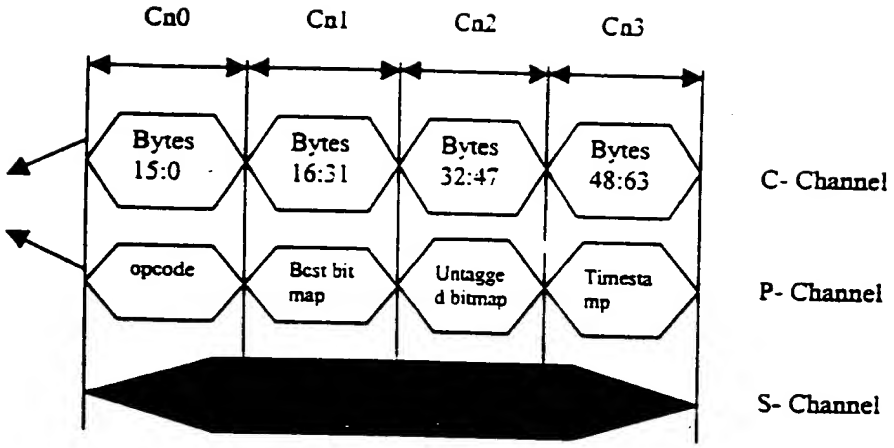

Cn0
Cn1
Cn2
Cn3
Bytes 15:0
Bytes 16:31
Bytes 32:47
Bytes 48:63
opcode
Best bit map
Untagged bitmap
Timestamp
Locked and sync to each other
C- Channel
P- Channel
S- Channel

Fig. 3

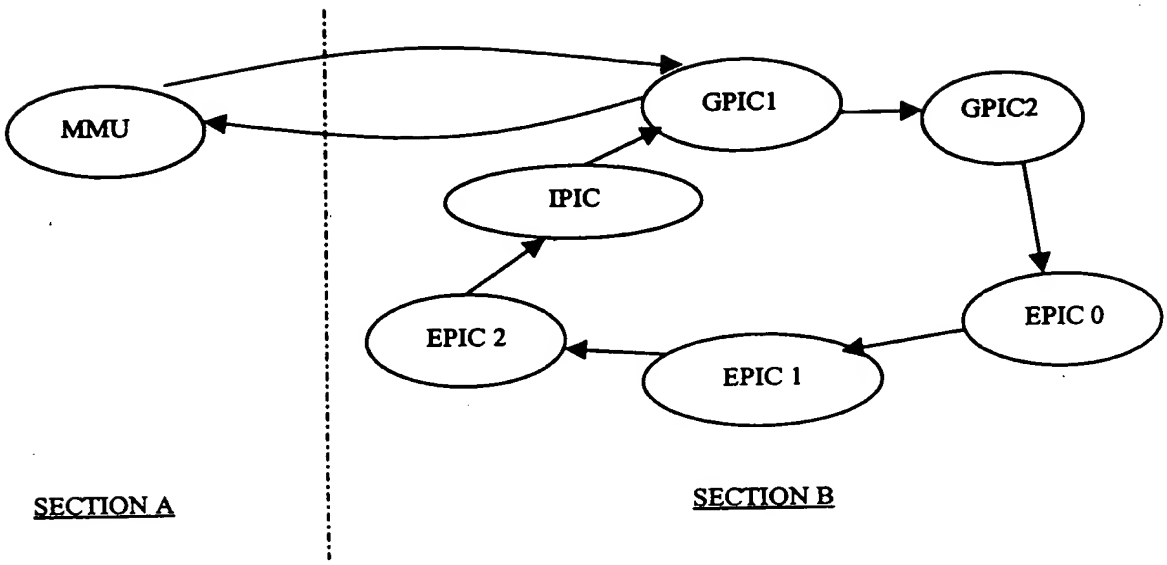

MMU
GPIC1
GPIC2
IPIC
EPIC 0
EPIC 2
EPIC 1
SECTION A
SECTION B

Fig. 4a

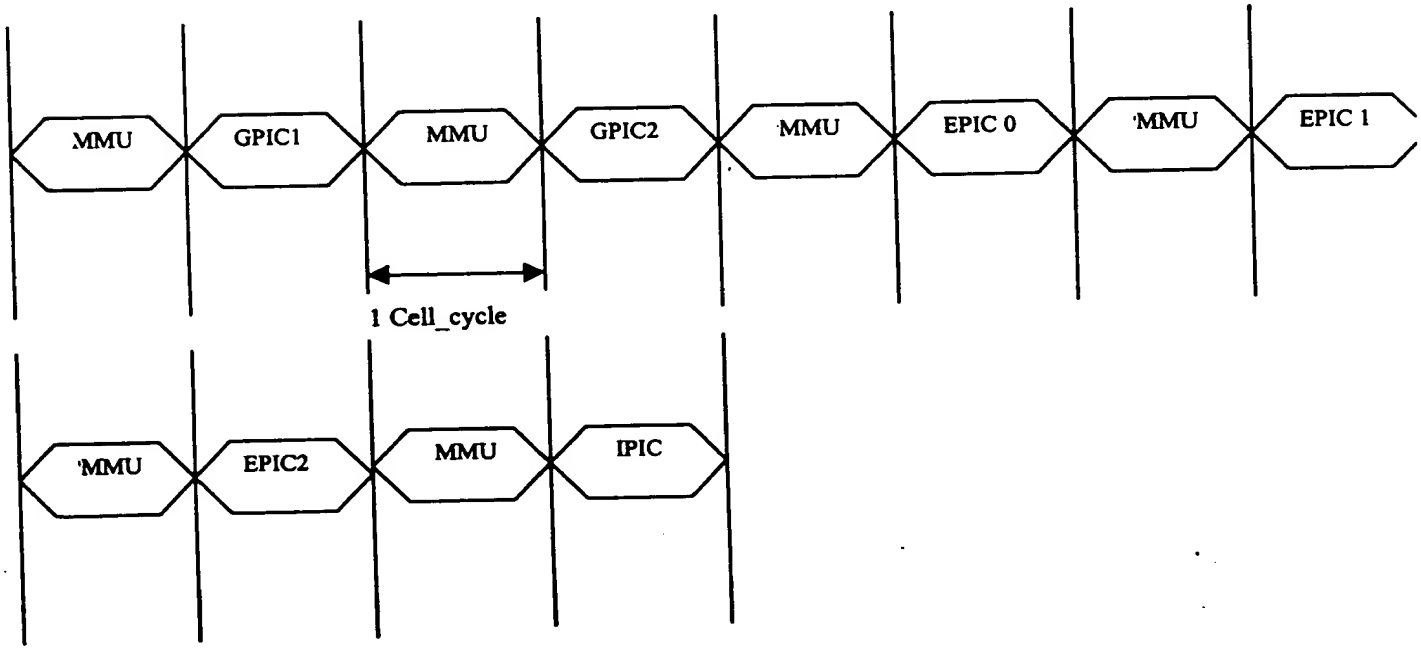

MMU
GPIC1
MMU
GPIC2
MMU
EPIC 0
MMU
EPIC 1
1 Cell_cycle
MMU
EPIC2
MMU
IPIC

Fig. 4b

Protocol Channel Messages

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
Opc ode	Ip IPX	Rese rved	Nxt cell	Src Dest Port			Cos	J	S	E	Cr c	P	O	Len	

62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32
Module Id Bitmap															

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
R	Bc/Mc Portbitmap														

62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32
PF M	New IP checksum								M	MT-ModId		T	TGID	Mod opcode	c

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
U	Untagged Portbitmap / Src Port Number (bit0..5)														

62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32
Rsvd		Matched Filter		Vlan Id						Src Port			Remote Port		

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
CPU Opcodes									TimeStamp						

62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32
R	L3 Port Bitmap														

Fig. 5

Side Band Channel Messages

30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
Opcode			Dest Port / Destination Dev Id			Src Port			DataLen			E	EC ode	Cos	C
Address															
Data															

Fig. 6

DOCKET NO. 50277-0010

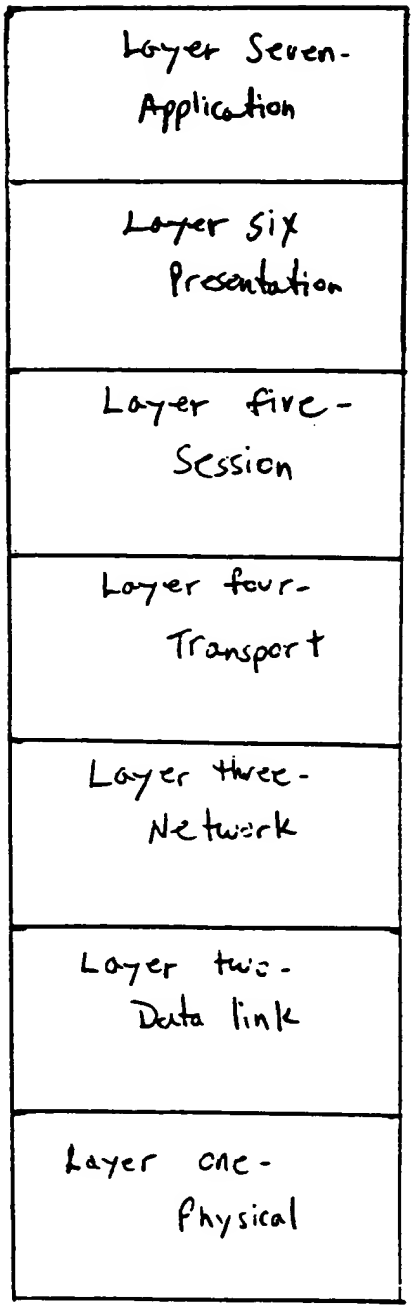


Figure 7
Prior Art

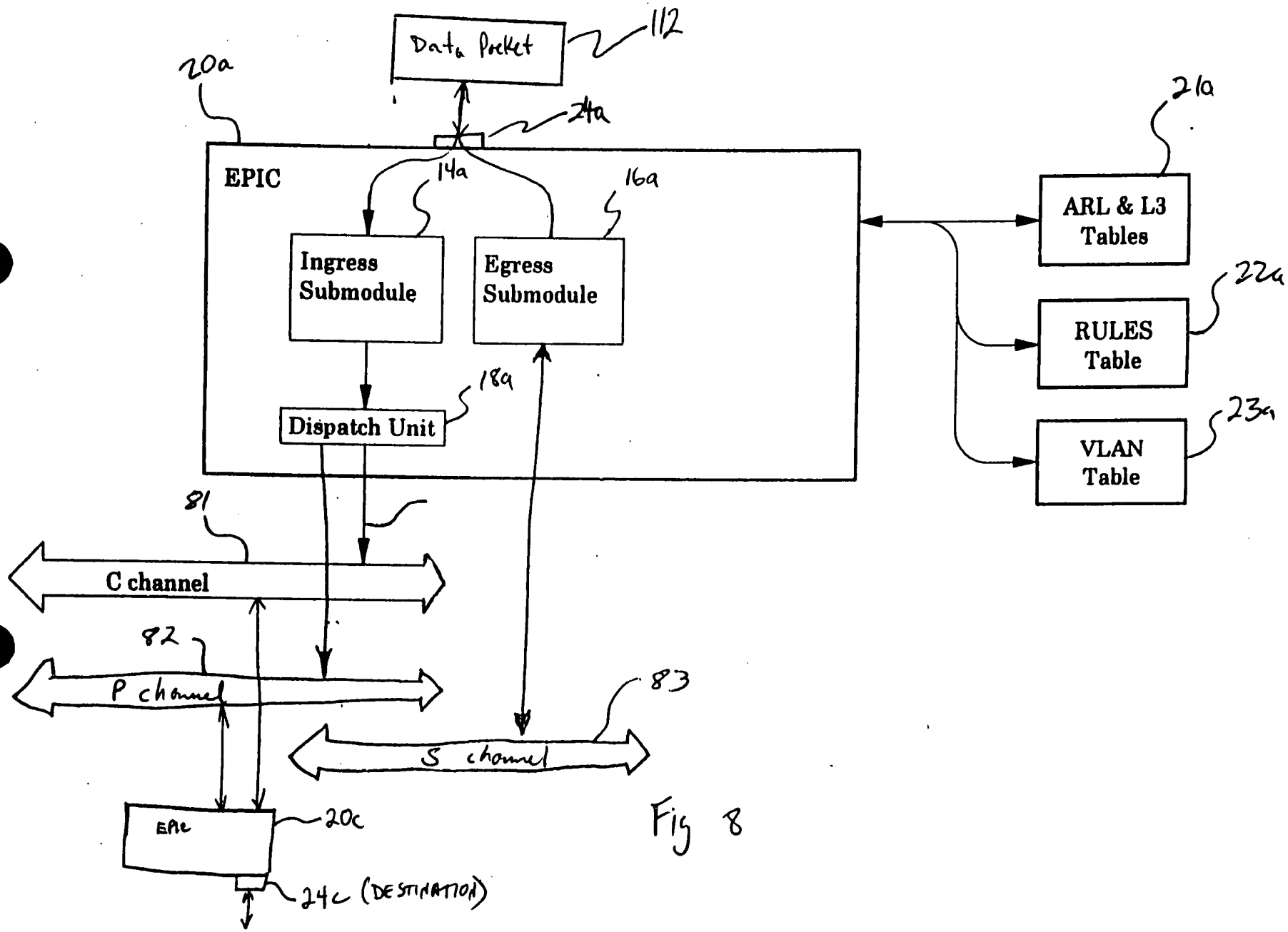


Fig 8

09527999.031700

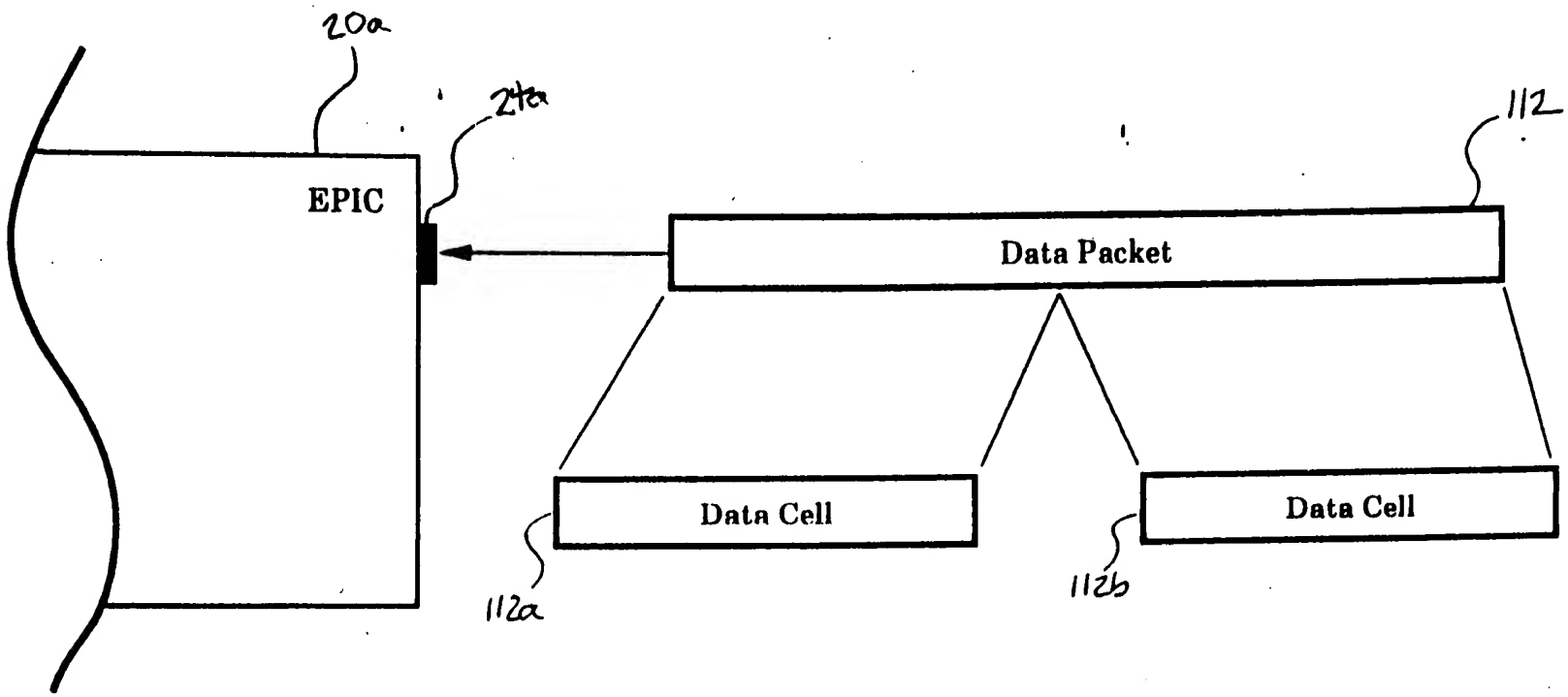


Fig. 9

09527999 .031700

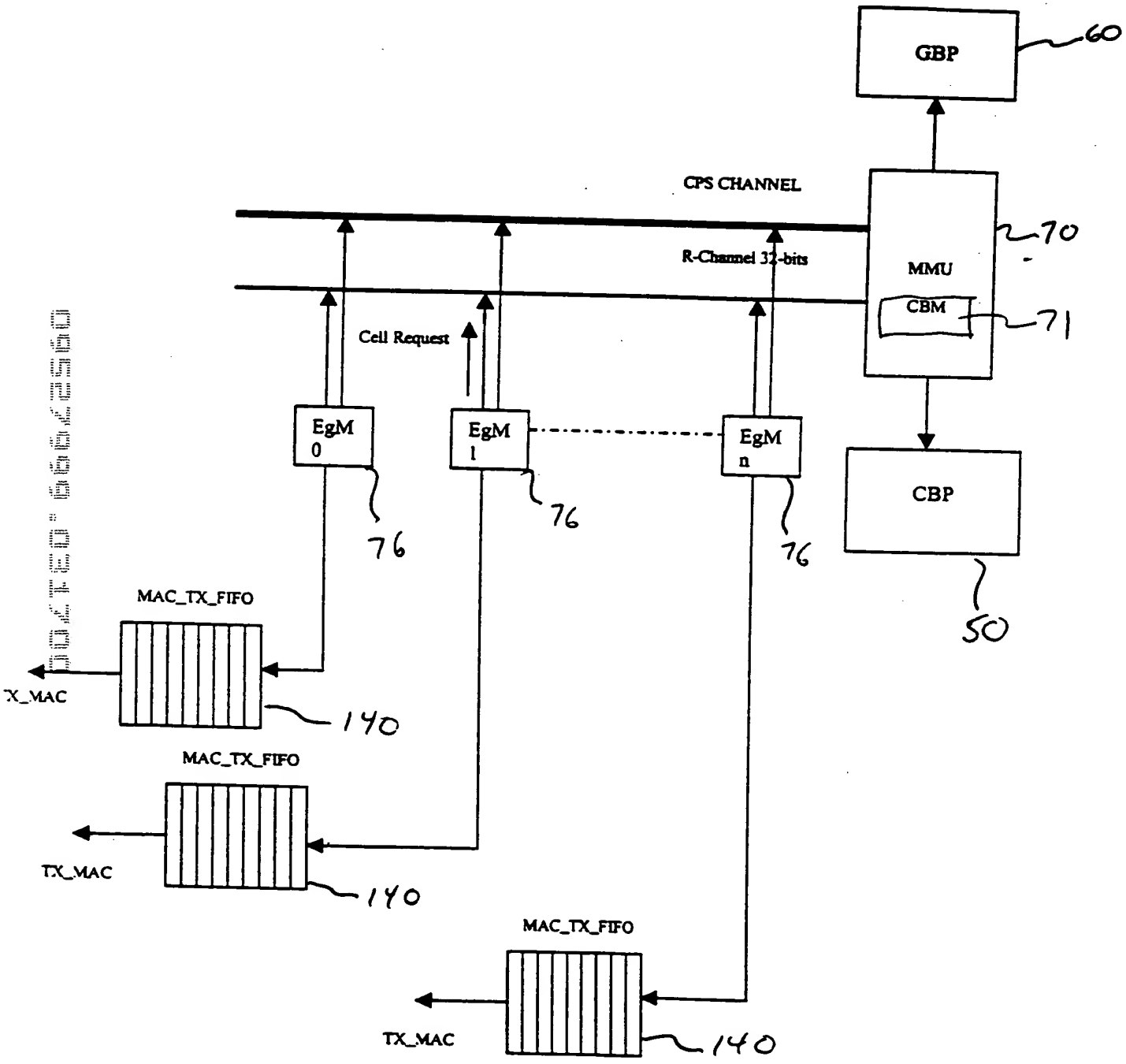

GBP
60
CPS CHANNEL
R-Channel 32-bits
MMU
70
CBM
71
Cell Request
EgM 0
EgM 1
EgM n
76
76
76
CBP
50
MAC_TX_FIFO
TX_MAC
140
MAC_TX_FIFO
TX_MAC
140
MAC_TX_FIFO
TX_MAC
140

Fig. 10

Line 0 →	FC | LC | BC/MC | Cpy_cnt(5b) | Cell_length (7b) | CRC (2b) | NC_header (16b) | Src Count(6)|IPX|IP| |Time_Stamp (14b) | O bits(2b) | P| NextCellLen(2b)|CpuOpcode(4b)| Cell_data (0-9B)
Line 1 →	Cell_data (10-27) Bytes
Line 2 →	Cell_data (28-45) Bytes
Line 3 →	Cell_data (46-63) Bytes

Fig. 11

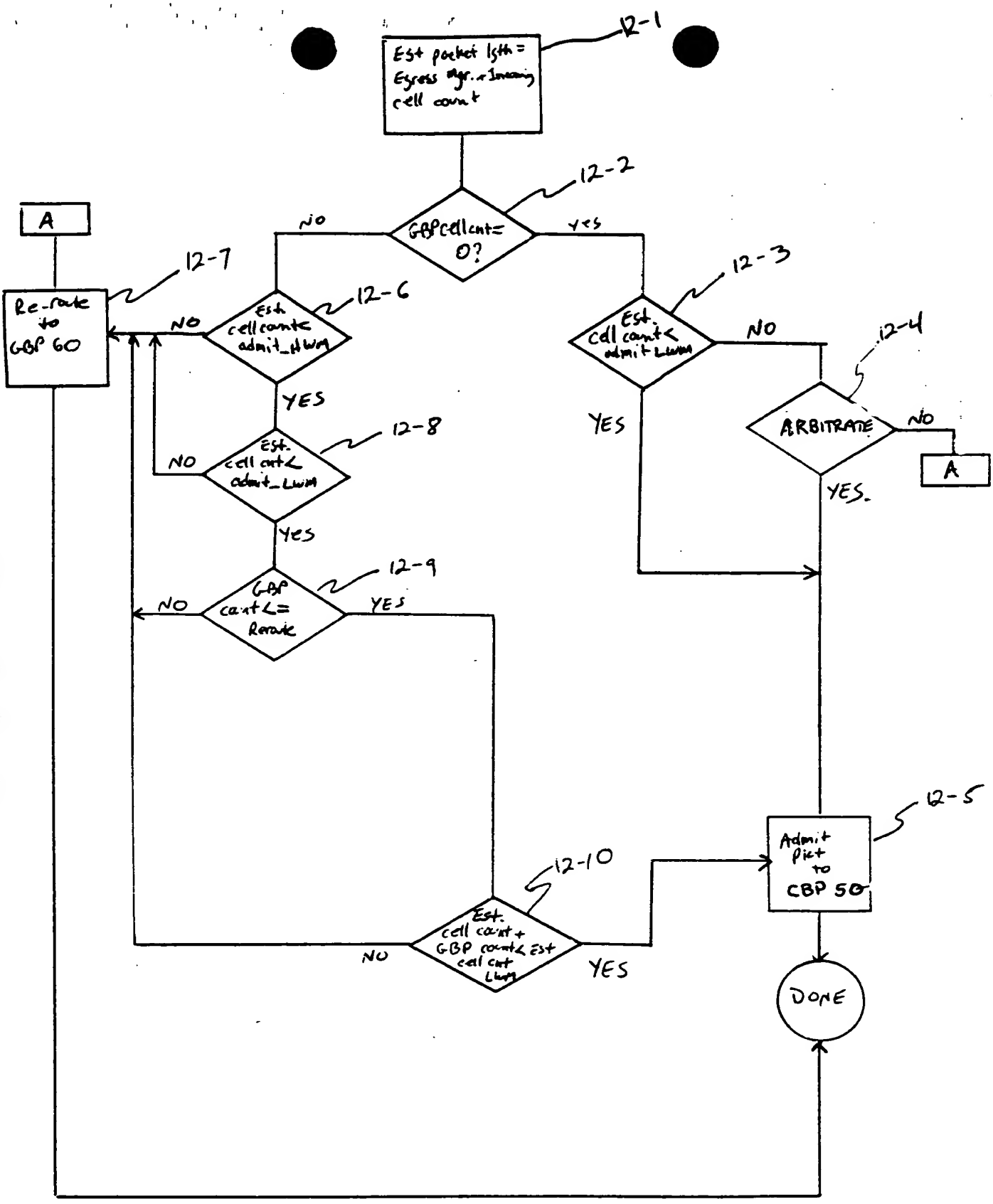

12-1
Est packet lgth = Egress mgr. Incoming cell count
12-2
GBP cell cnt = 0?
NO
YES
A
12-7
Re-route to GBP 60
12-6
Est cell cnt < admit_HWM
NO
YES
12-3
Est. cell cnt < admit LWM
NO
YES
12-4
ARBITRATE
NO
A
YES
12-8
Est. cell cnt < admit_LWM
NO
YES
12-9
GBP cnt < = Reroute
NO
YES
12-5
Admit pkt to CBP 50
12-10
Est. cell cnt + GBP count < Est cell cnt LWM
NO
YES
DONE

Fig. 12

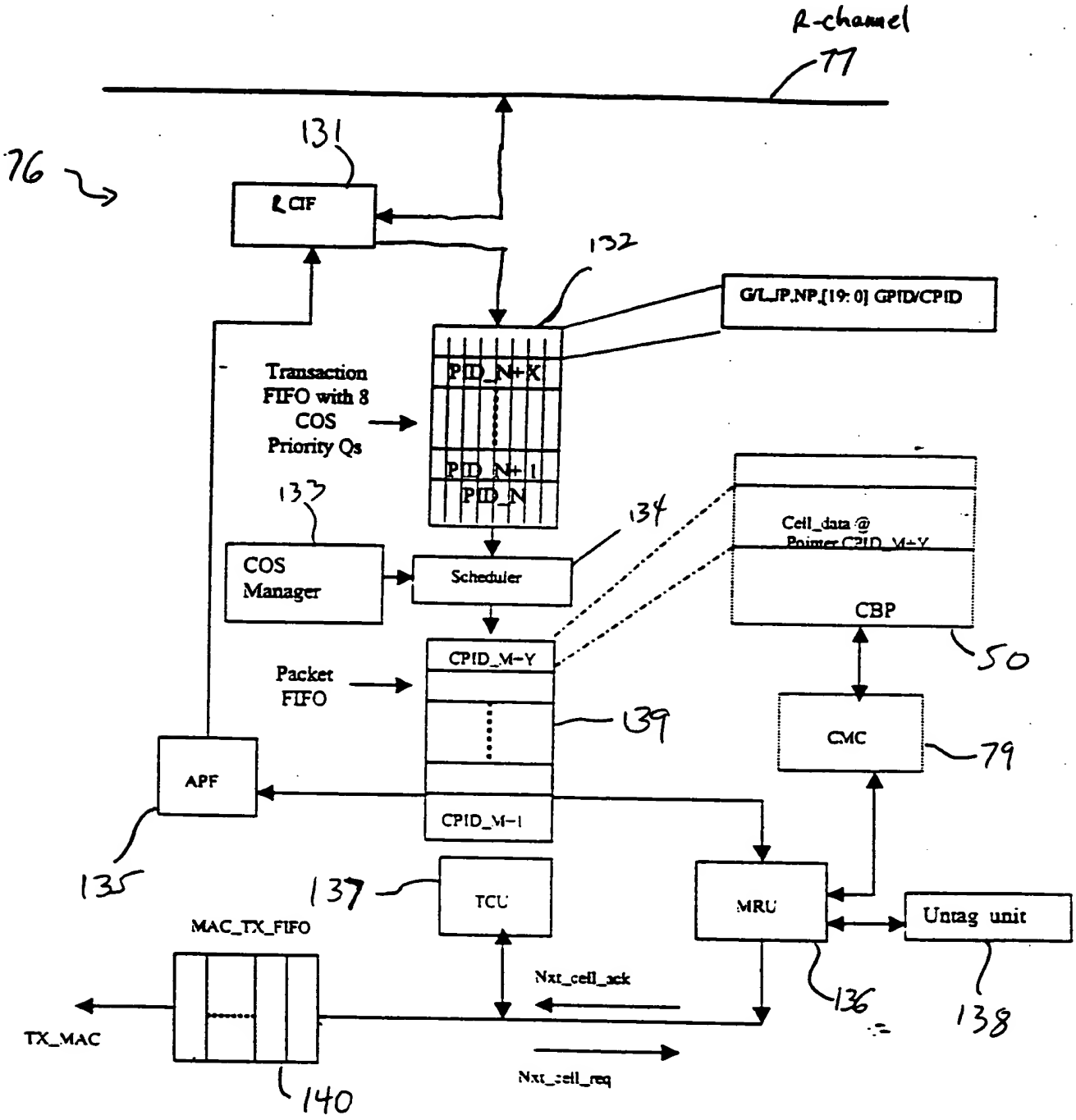

R-channel
77
131
76
LCIF
132
G/L_IP.NP.[19: 0] GPID/CPID
PID_N+K
Transaction FIFO with 8 COS Priority Qs
PID_N+1
PID_N
133
134
Cell_data @ Pointer CPID_M-Y
COS Manager
Scheduler
CBP
50
CPID_M-Y
Packet FIFO
139
CMC
79
APF
CPID_M-1
135
137
TCU
MRU
Untag unit
MAC_TX_FIFO
Nxt_cell_ack
136
138
TX_MAC
Nxt_cell_req
140

Fig 13

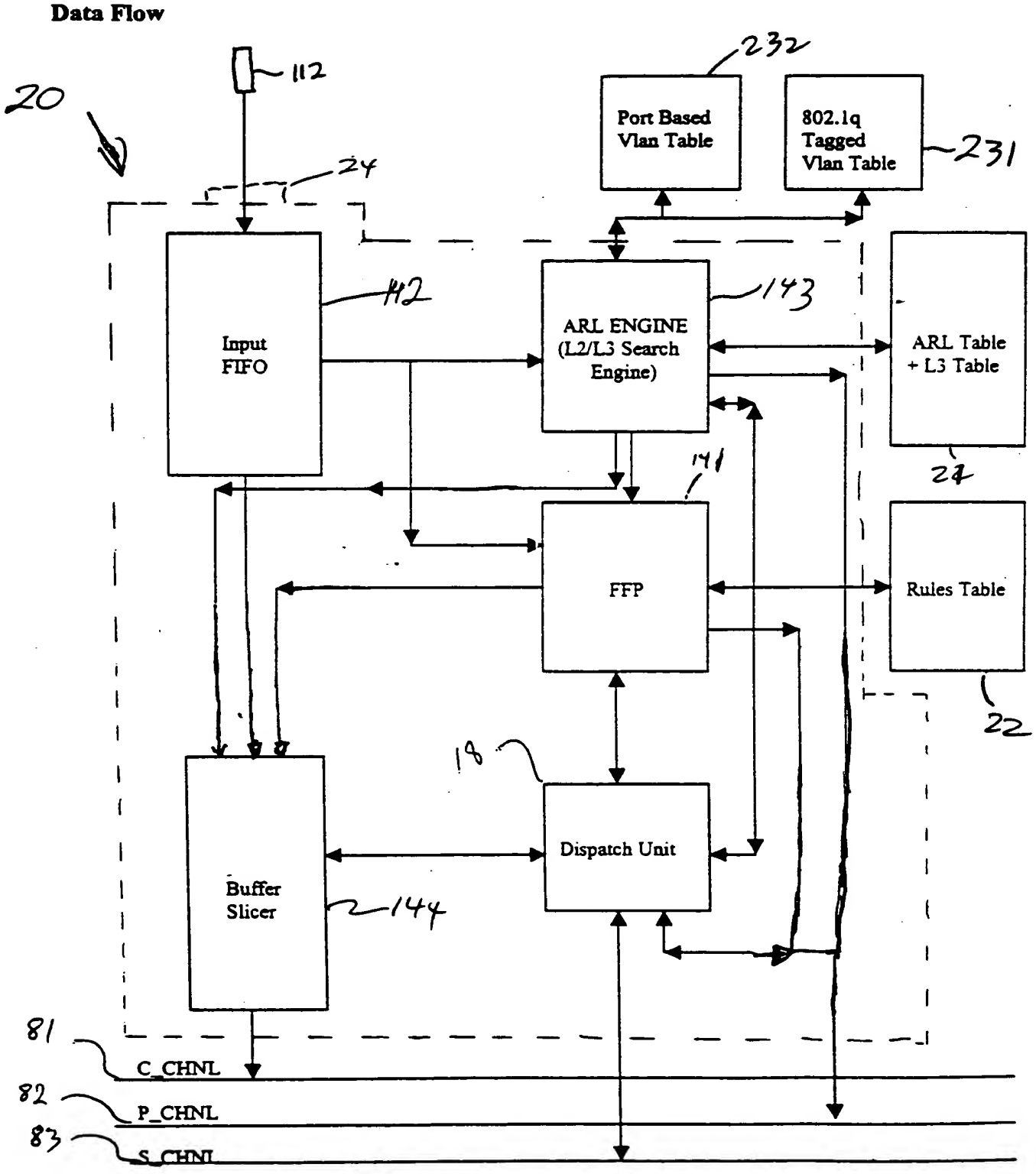

Data Flow
20
112
24
232
Port Based Vlan Table
802.1q Tagged Vlan Table
231
Input FIFO
142
ARL ENGINE (L2/L3 Search Engine)
143
ARL Table + L3 Table
24
141
FFP
Rules Table
22
18
Dispatch Unit
Buffer Slicer
144
81
C_CHNL
82
P_CHNL
83
S_CHNL

Fig. 14

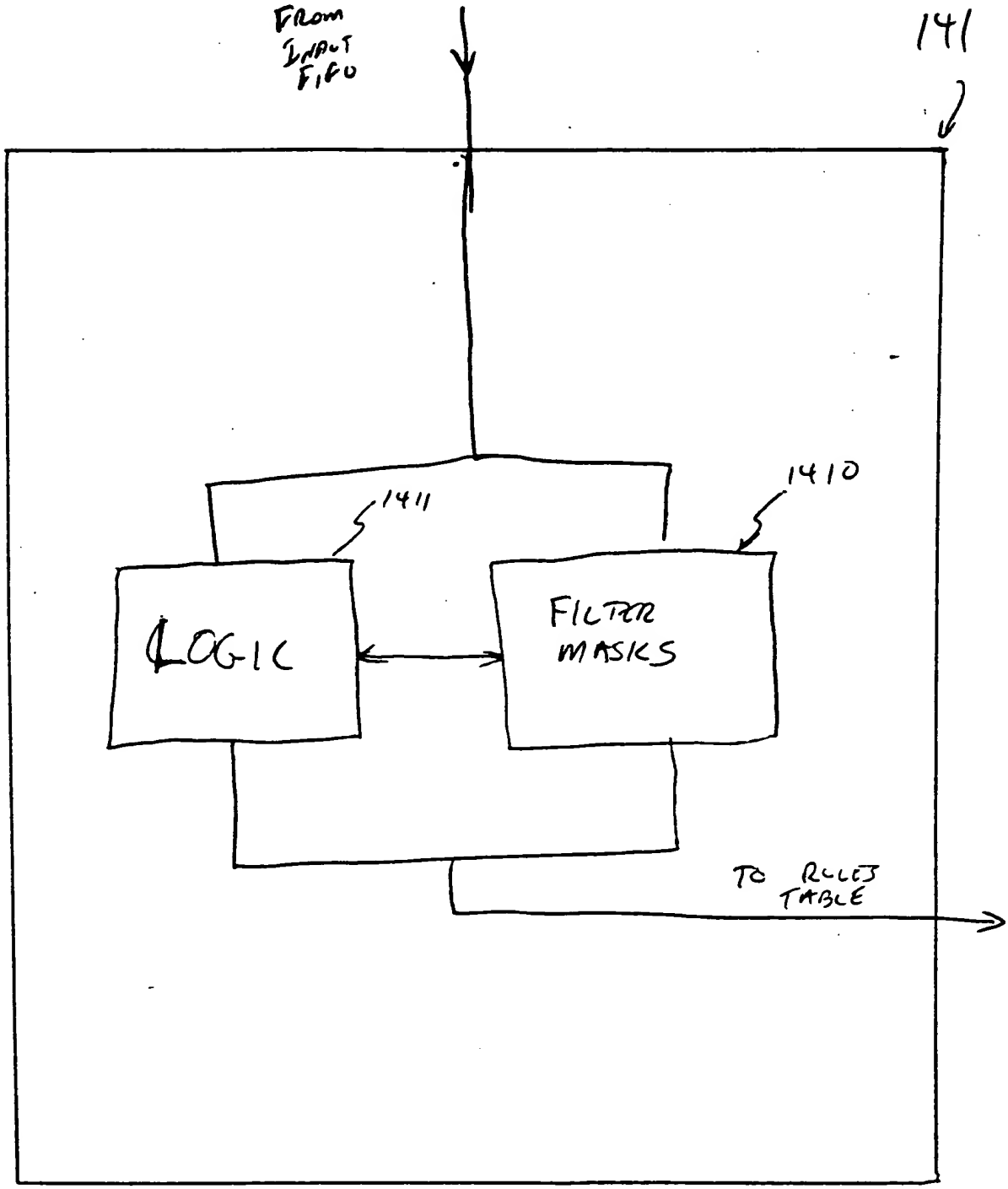

FROM INPUT FIFO
141
1410
1411
LOGIC
FILTER MASKS
TO RULES TABLE

FIG. 15

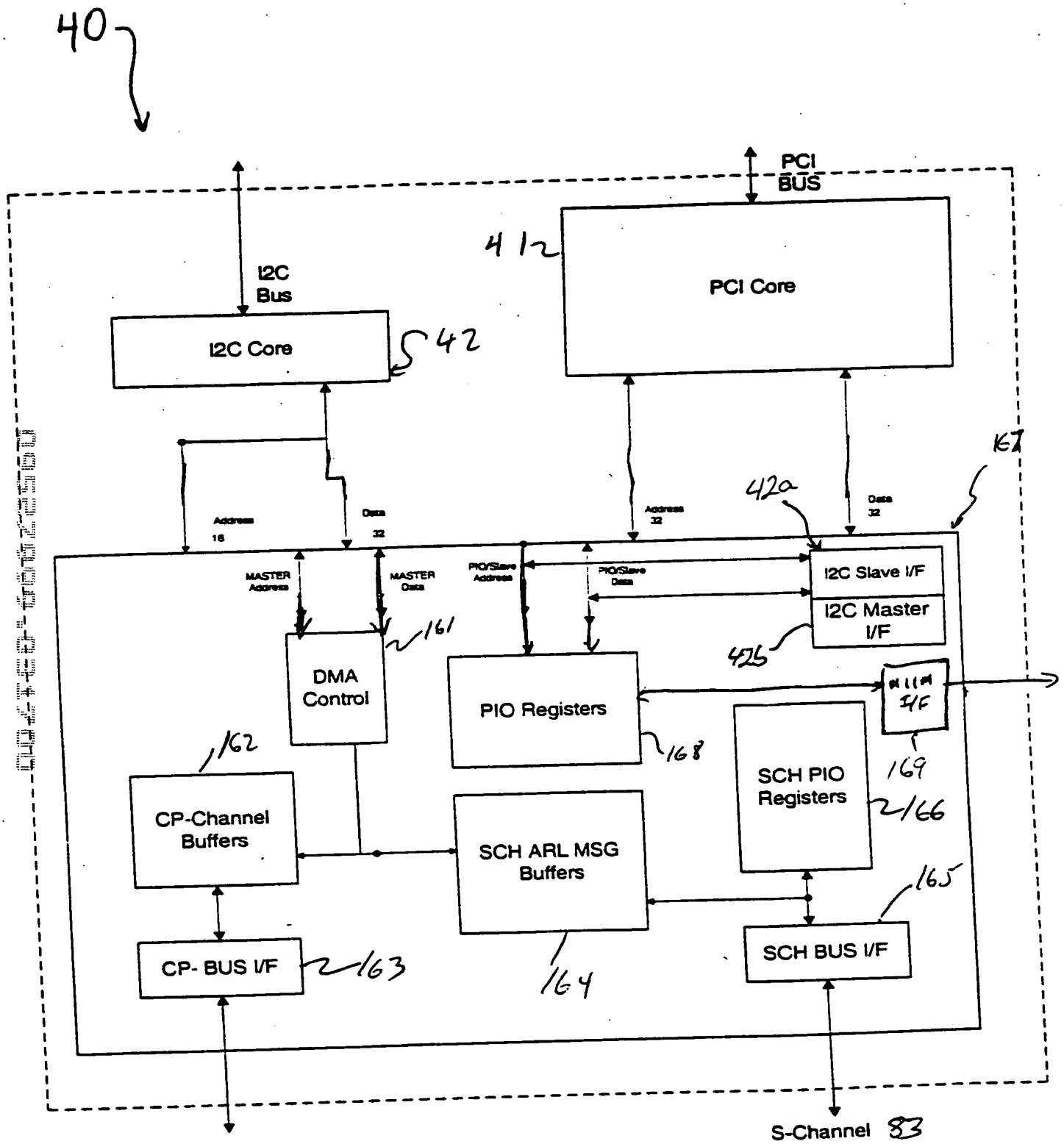

40
PCI BUS
412
PCI Core
I2C Bus
I2C Core
42
Address 16
Data 32
Address 32
Data 32
42a
I2C Slave I/F
I2C Master I/F
425
MASTER Address
MASTER Data
PIO/Slave Address
PIO/Slave Data
DMA Control
161
PIO Registers
168
162
CP-Channel Buffers
SCH ARL MSG Buffers
SCH PIO Registers
169
166
165
CP- BUS I/F
163
164
SCH BUS I/F
S-Channel 83
C channel 81
P channel 82

Fig. 16

FFP Programming Flow Chart

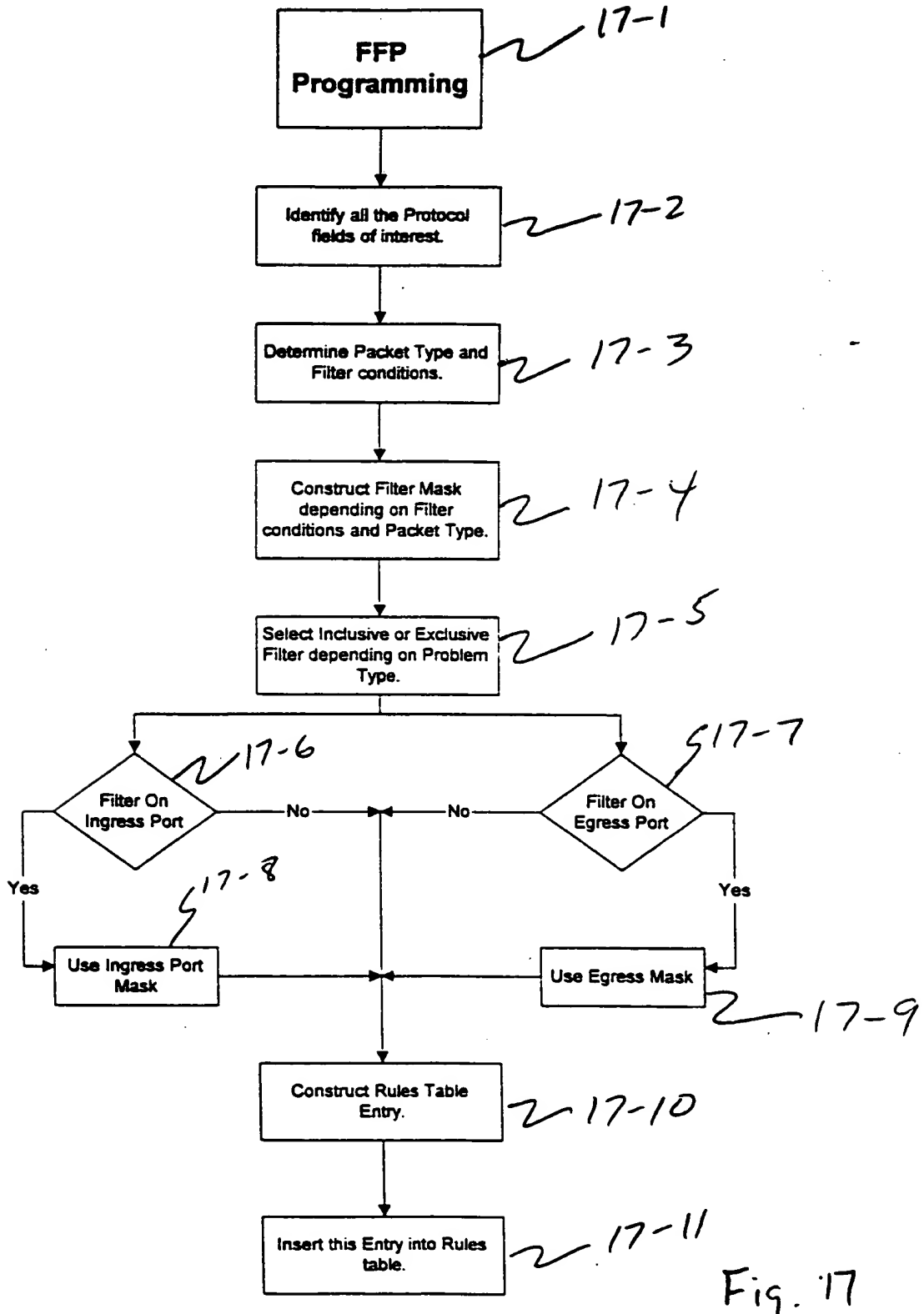


Fig. 17

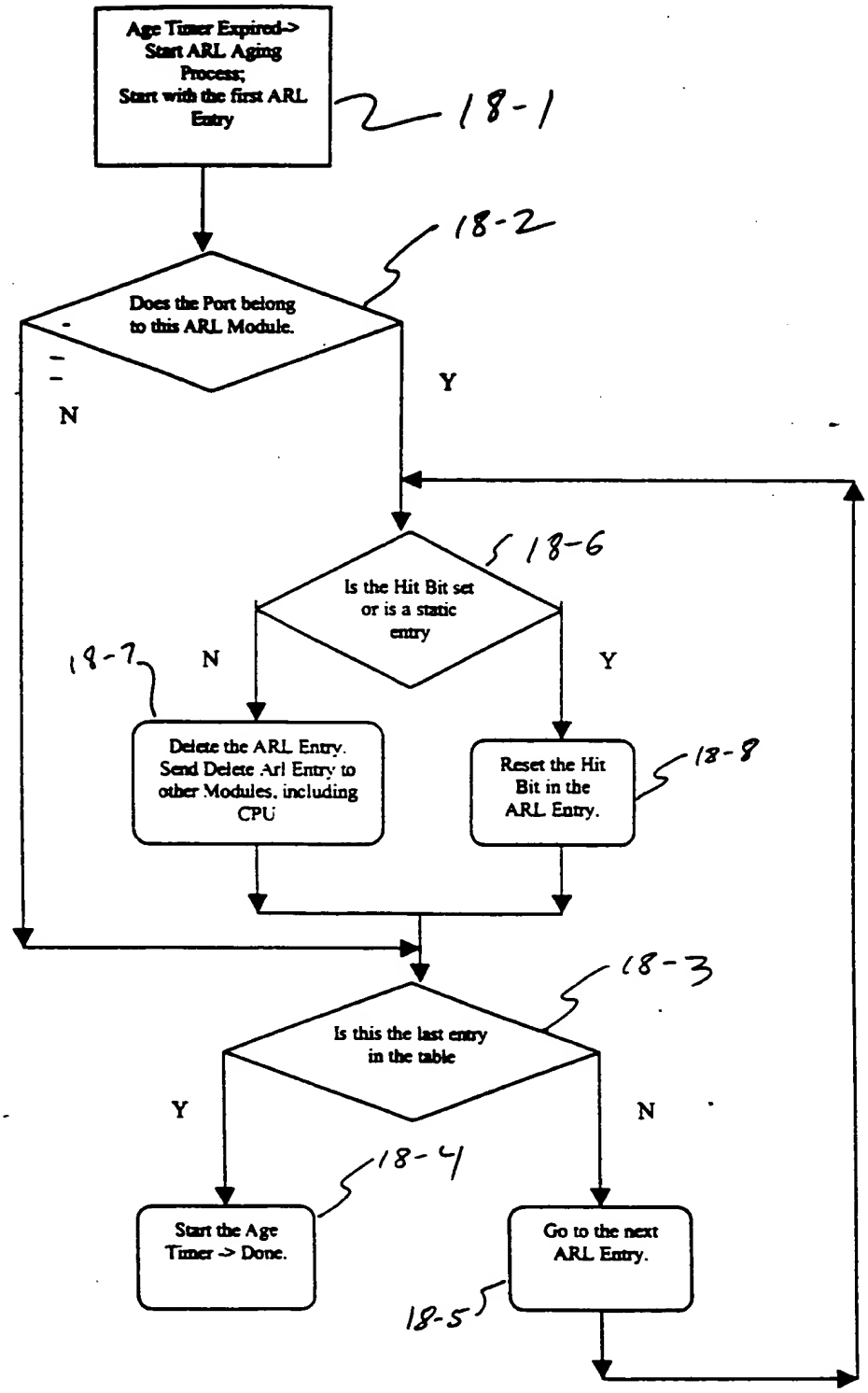

Age Timer Expired-> Start ARL Aging Process; Start with the first ARL Entry
18-1
18-2
Does the Port belong to this ARL Module.
N
Y
18-6
Is the Hit Bit set or is a static entry
18-7
N
Y
Delete the ARL Entry. Send Delete Arl Entry to other Modules, including CPU
Reset the Hit Bit in the ARL Entry.
18-8
18-3
Is this the last entry in the table
Y
N
18-4
Start the Age Timer -> Done.
Go to the next ARL Entry.
18-5

Fig. 18

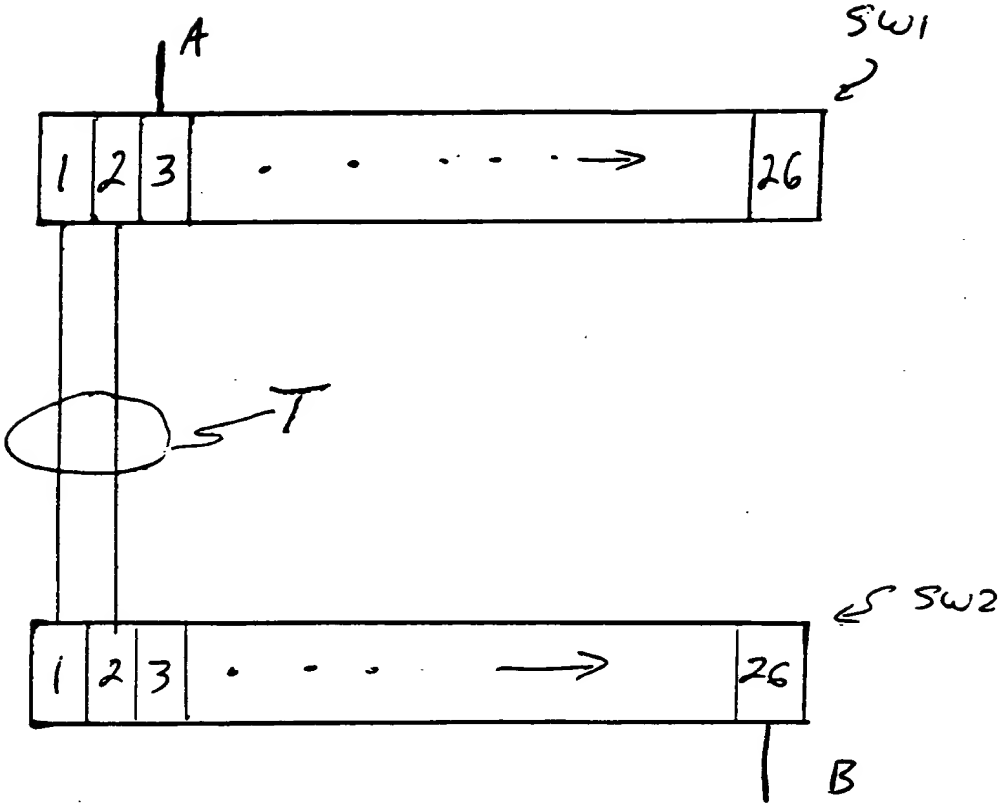


Fig. 19

Field	Header	Size	Offset For Ethernet II Untagged	Offset For Ethernet II Tagged	Offset For SNAP Untagged	Offset For SNAP Tagged
Destination Mac Address	Mac	6 Bytes	0	0	0	0
Source Mac Address	Mac	6 Bytes	6	6	6	6
Protocol Type	Mac	2 Bytes	12	16	20	24
Destination SAP	802.3	1 Byte	NA	NA	14	18
Source SAP	802.3	1 Byte	NA	NA	15	19
802.1p Priority	Mac	3 bits	NA	14	NA	14
VLAN Id	Mac	12 bits	NA	14+ 4b	NA	14+4b
TOS Precedence	IP	3 bits	15	19	23	27
Differentiated Services	IP	6 bits	15	19	23	27
Source IP Address	IP	4 Bytes	26	30	34	38
Destination IP Address	IP	4 Bytes	30	34	38	42
Protocol	IP	1 Byte	23	27	31	35
Source Port	TCP/ UDP	2 Bytes	34	38	42	46
Destination Port	TCP/ UDP	2 Bytes	36	40	44	48
TCP Control Flags (For aligning on Byte boundary 2 bits of reserved bits preceding this field is included)	TCP	1 Byte	47	51	55	59
Data at Offset 1	NA	8 Bytes	Data Offset1 From start of IP / IPX Header	Data Offset1 From start of IP / IPX Header	Data Offset1 From start of IP / IPX Header	Data Offset1 From start of IP / IPX Header
Data at Offset 2	NA	8 Bytes	Data Offset2 From start of IP / IPX Header	Data Offset2 From start of IP /IPX Header	Data Offset2 From start of IP / IPX Header	Data Offset2 From start of IP / IPX Header
Data at Offset 3	NA	8 Bytes	Data Offset3 From start of IP / IPX Header	Data Offset3 From start of IP / IPX Header	Data Offset3 From start of IP / IPX Header	Data Offset3 From start of IP / IPX Header
Data at Offset 4	NA	8 Bytes	Data Offset4 From start of IP /IPX Header	Data Offset4 From start of IP / IPX Header	Data Offset4 From start of IP / IPX Header	Data Offset4 From start of IP / IPX Header

FIGURE 20

Fig. 21a

Filter Mask Format:

Filter Enable (1b)	Counter (5b)	Rem Port (1b)	Output Mod (5b)	Output Port (6b)	TOS Prec (3b)	Diff Serv (6b)	802.1p Prior (3b)

NMA Enb (1b)	No Match Action (10b)	Data Offset 4 (7b)	Data Offset 3 (7b)	Data Offset 2 (7b)	Data Offset 1 (7b)	Ingress Port Mask (6b)	Egress ModId Mask (5b)	Egress Port Mask (6b)

Field Mask

Field Mask Format:

Dest Mac addr (6 B)	Src Mac addr (6 B)	Prot type (2 B)	Dest SAP (1 B)	Src SAP (1 B)	802.1 p Prio (3 b)	Vlan Id (12b)	TOS Prec (3b)	Diff Serv (6b)	Src IP addr (4B)	Dest IP addr (4 B)	Prot IP- (1B)	Src Port (2B)	Dest Port (2B)

TCP Cntr Flags (1B)	Data 1 (8B)	Data 2 (8 B)	Data 3 (8B)	Data 4 (8B)

Fig 21b.

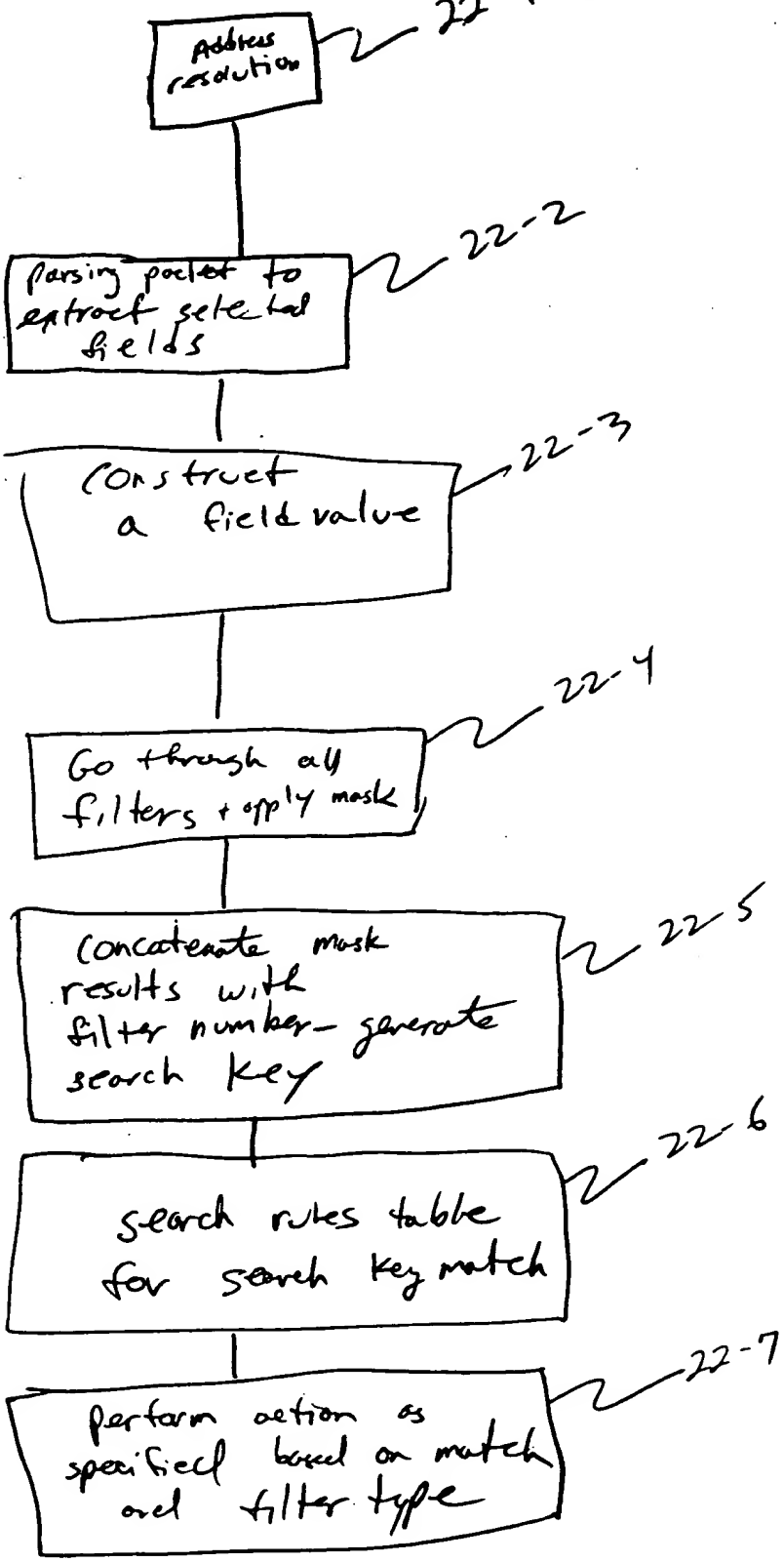

Address resolution
22-1
Parsing packet to extract selected fields
22-2
Construct a field value
22-3
Go through all filters + apply mask
22-4
Concatenate mask results with filter number - generate search key
22-5
Search rules table for search key match
22-6
Perform action as specified based on matched filter type
22-7

Fig. 22

22

Counter (5b)	Output Mod (5b)	Output Port (6b)	TOS_P (3b)	Diff Services (6b)	802.1p Priority (3b)	Actions (11b)	Filter Select (3b)	Ingress Port (6b)	Egrs Mod (5b)	Egrs Port (6b)	Filter Value (512 b)

Fig. 23

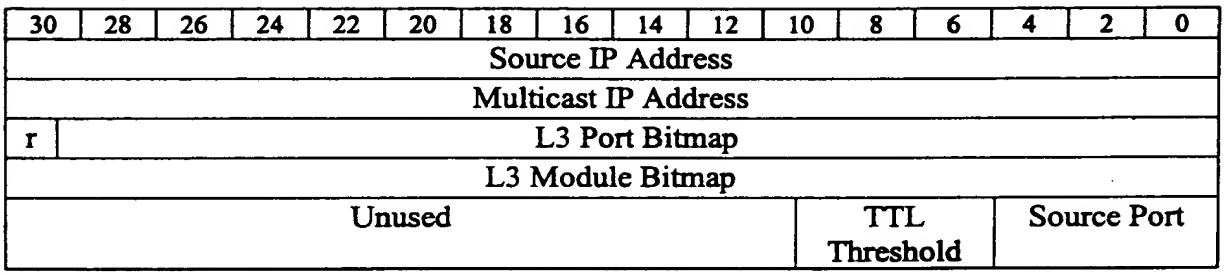

30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
Source IP Address
Multicast IP Address
r
L3 Port Bitmap
L3 Module Bitmap
Unused
TTL Threshold
Source Port

Fig. 24

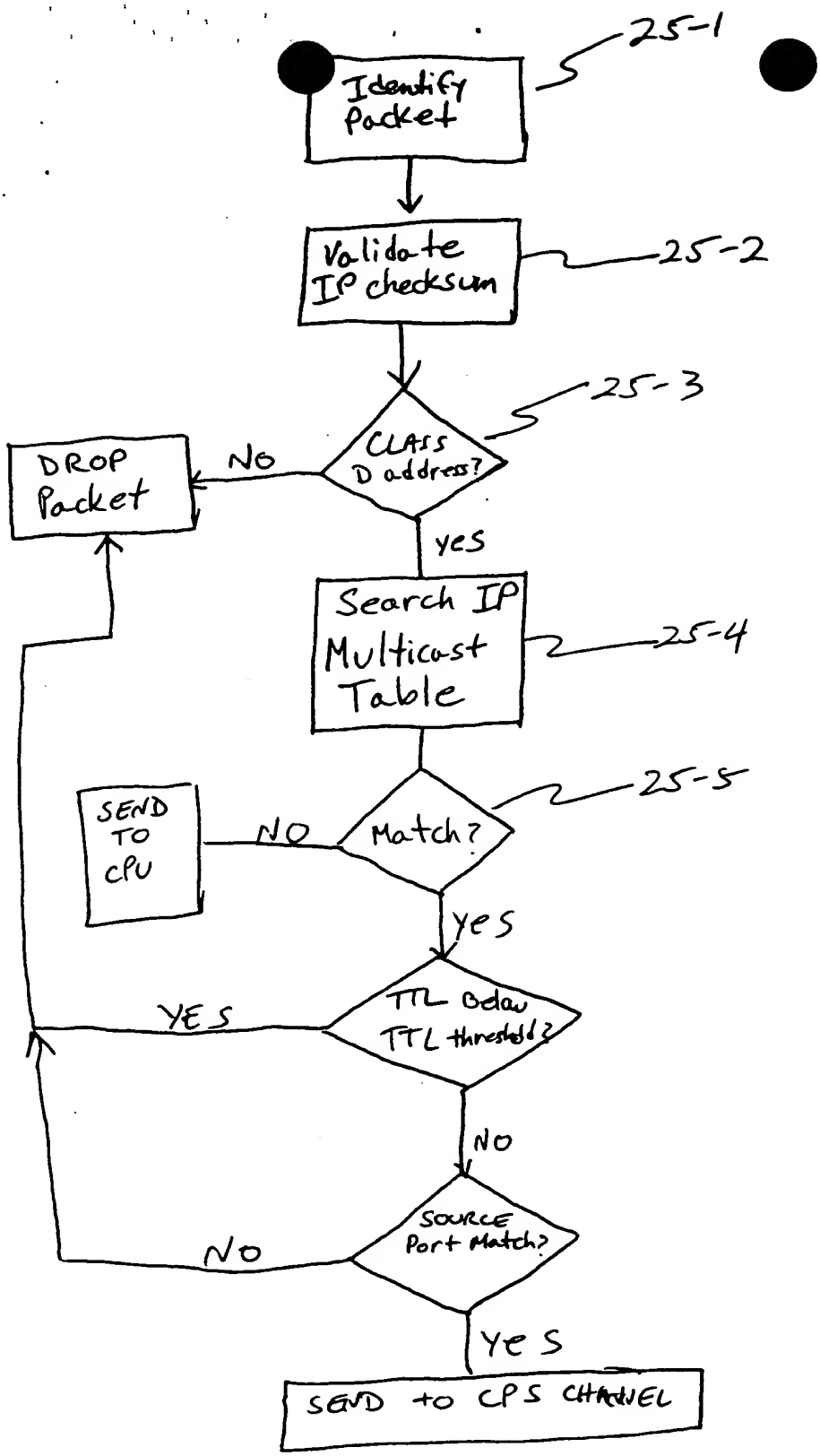

Identify Packet
25-1
Validate IP checksum
25-2
CLASS D address?
25-3
NO
DROP Packet
yes
Search IP Multicast Table
25-4
Match?
25-5
NO
SEND TO CPU
yes
TTL 0 dec TTL threshold?
YES
NO
SOURCE Port Match?
NO
Yes
SEND to CPS CHANNEL

Fig. 25

DOCKET NO. 60,255.50

Fig. 2b

Fig. 27a

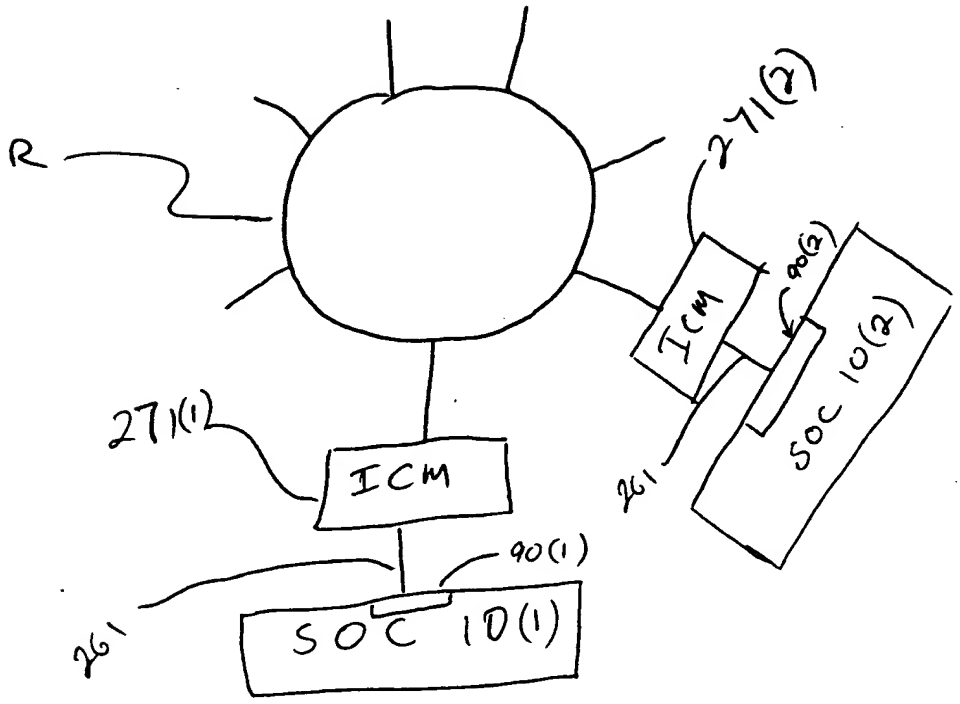
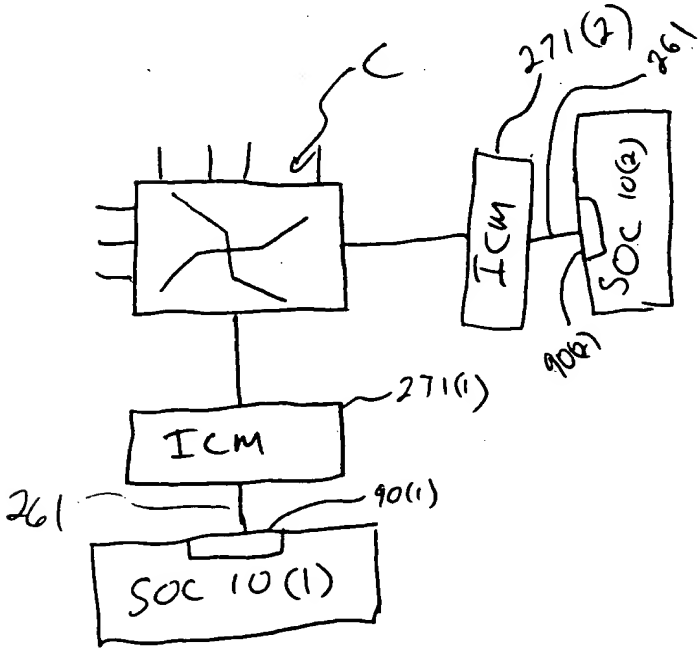


Fig. 27b



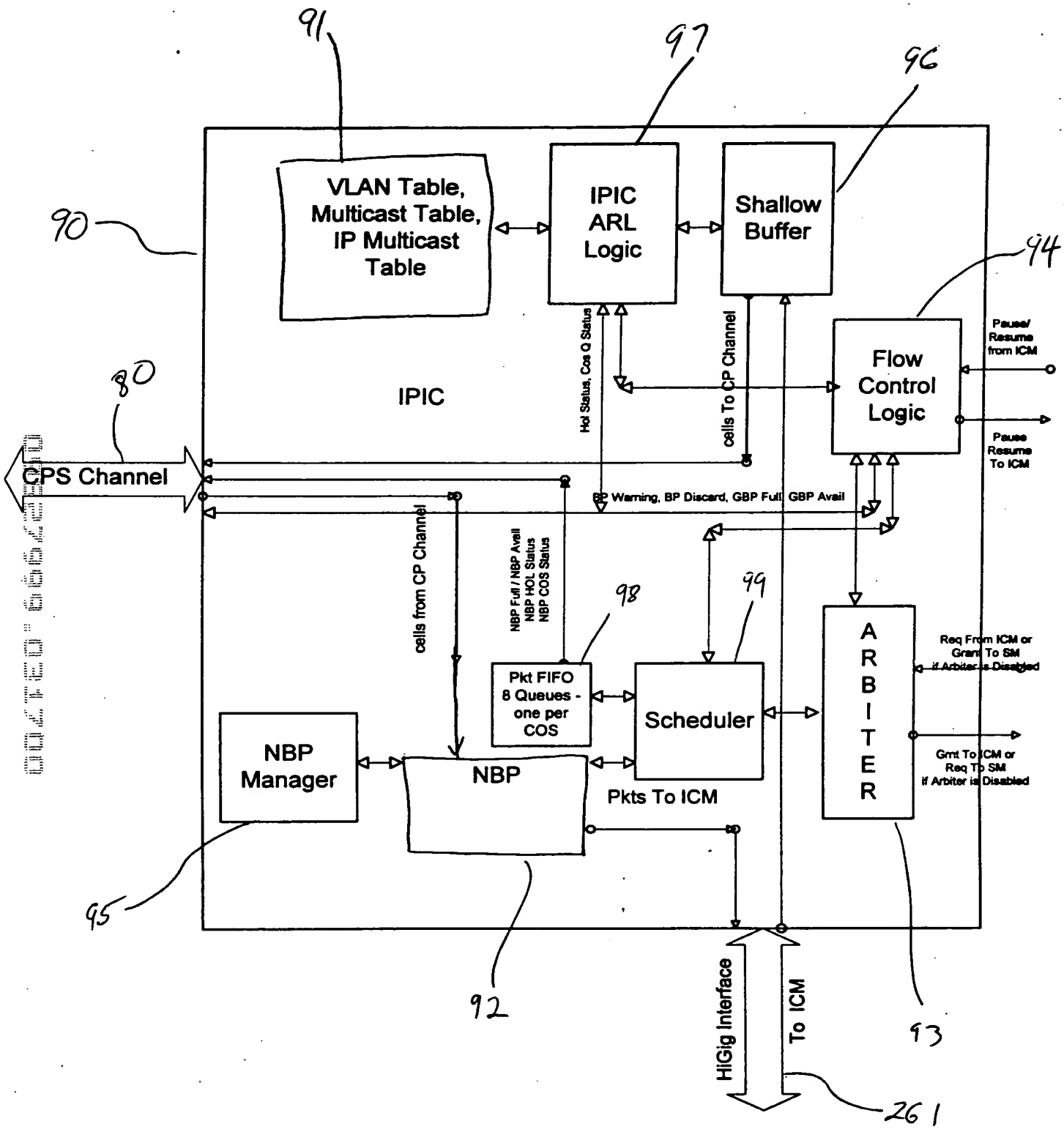

91
97
96
90
VLAN Table, Multicast Table, IP Multicast Table
IPIC ARL Logic
Shallow Buffer
94
IPIC
Hol Status, Cos Q Status
cells To CP Channel
Flow Control Logic
Pause/ Resume from ICM
Pause Resume To ICM
80
CPS Channel
BP Warning, BP Discard, GBP Full, GBP Avail
cells from CP Channel
NBP Full / NBP Avail
NBP HOL Status
NBP COS Status
98
99
Pkt FIFO 8 Queues - one per COS
Scheduler
A R B I T E R
Req From ICM or Grant To SM if Arbiter is Disabled
Grnt To ICM or Req To SM if Arbiter is Disabled
NBP Manager
NBP
Pkts To ICM
95
92
93
HiGig Interface
To ICM
261

Fig 28.

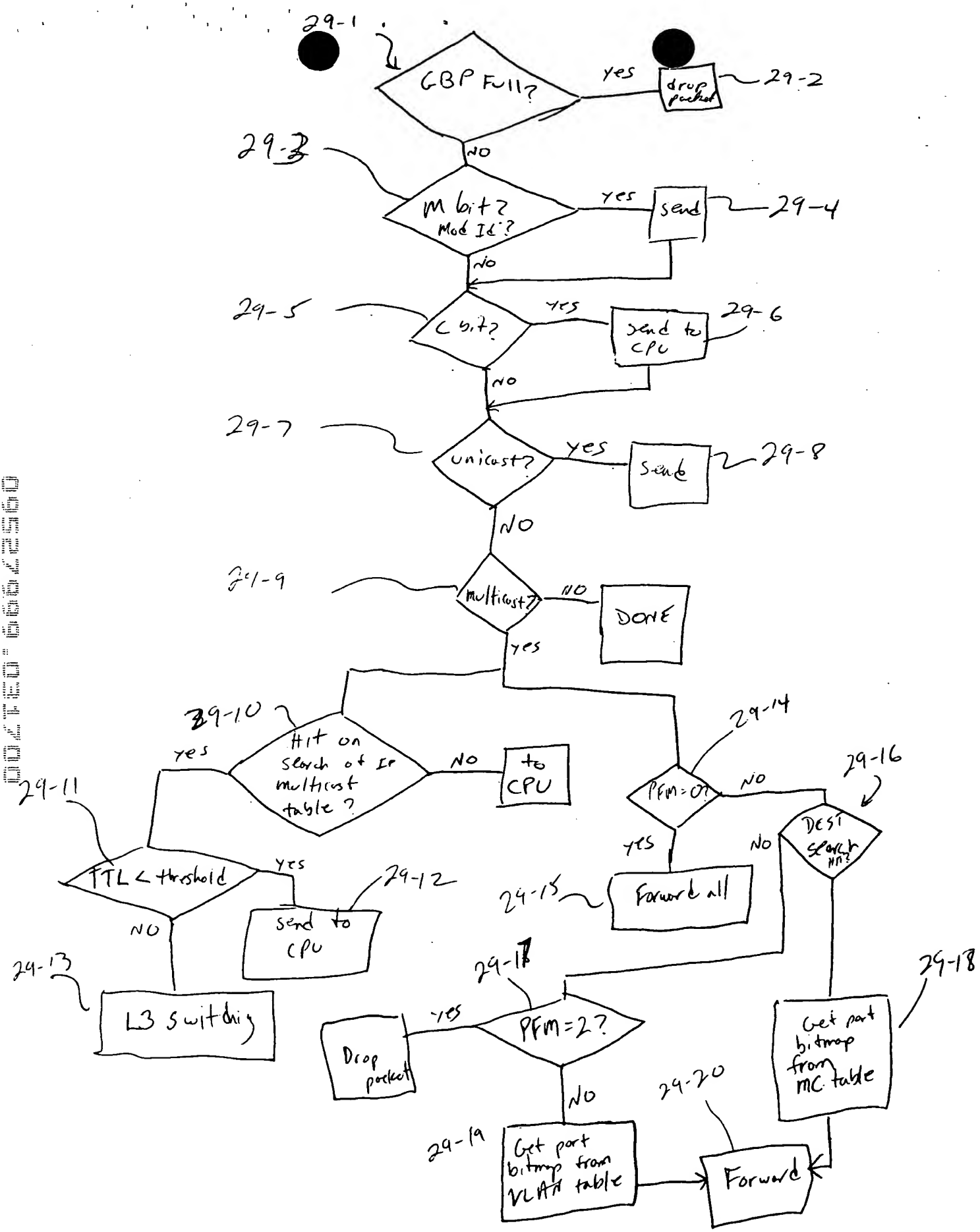

29-1
GBP Full?
yes
drop packet
29-2
no
29-3
IM bit? Mod Id?
yes
send
29-4
no
29-5
C bit?
yes
send to CPU
29-6
no
29-7
unicast?
yes
send
29-8
no
29-9
multicast?
NO
DONE
yes
29-10
Hit on search of IP multicast table?
yes
NO
to CPU
29-11
TTL < threshold
yes
29-12
send to CPU
NO
29-13
L3 switching
29-14
PFM=0?
NO
yes
29-15
Forward all
29-16
DEST search hit?
NO
29-17
PFM=2?
yes
Drop packet
NO
29-18
Get port bitmap from MC table
29-19
Get port bitmap from VLAN table
29-20
Forward

Fig. 29

COS Queue (3b)	C P F	NCA (2b)	802.1p Priority (3b)	Rate Counter (8b)	Rate Counter Threshold (8b)	Rate Discard Threshold (8b)	New Code Point (6b)	New COS Queue (3b)	New 802.1 Priority (3b)

FIGURE 30

Offset Field	Offset 1	Offset 2	Offset 3	Offset 4
000	0-15	16-31	32-47	48-63
001	8-23	24-39	40-55	56-71
010	16-31	32-47	48-63	64-79
011	24-39	40-55	56-71	72-87
100	32-47	48-63	64-79	80-95
101	40-55	56-71	72-87	88-103
110	48-63	64-79	80-95	96-111
111	56-71	72-87	88-103	104-119

Figure 31

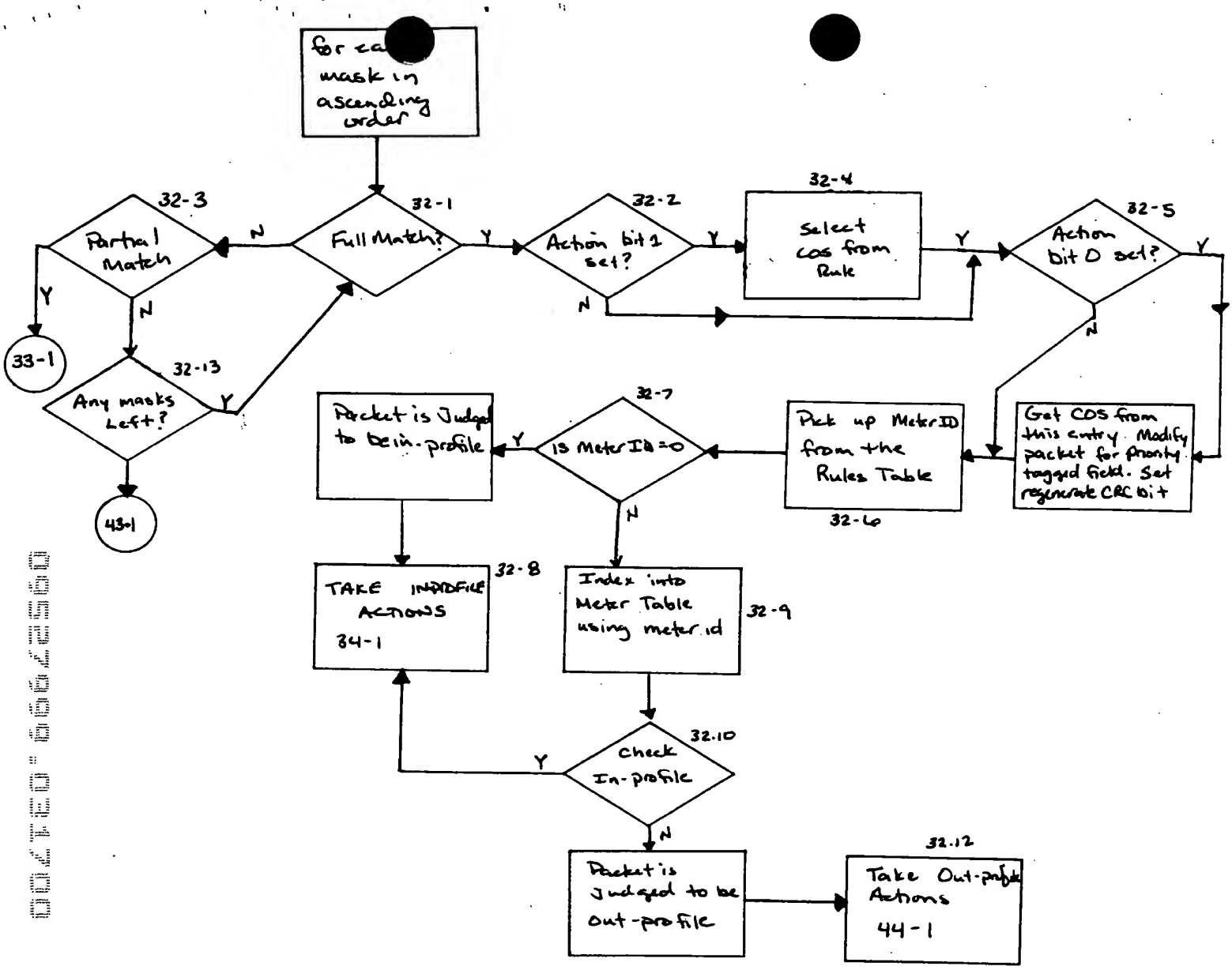

for ea mask in ascending order
32-1
Full Match?
32-2
Action bit 1 set?
32-4
Select cos from Rule
32-5
Action bit 0 set?
32-3
Partial Match
33-1
32-13
Any masks Left?
43-1
Get COS from this entry. Modify packet for priority tagged field. Set regenerate CRC bit
Pick up MeterID from the Rules Table
32-6
32-7
IS MeterID=0
Packet is Judged to be in-profile
TAKE INPROFILE ACTIONS
34-1
32-8
Index into Meter Table using meter id
32-9
32.10
Check In-profile
Packet is Judged to be out-profile
32.12
Take Out-profile Actions
44-1
Y
N

FIGURE 32

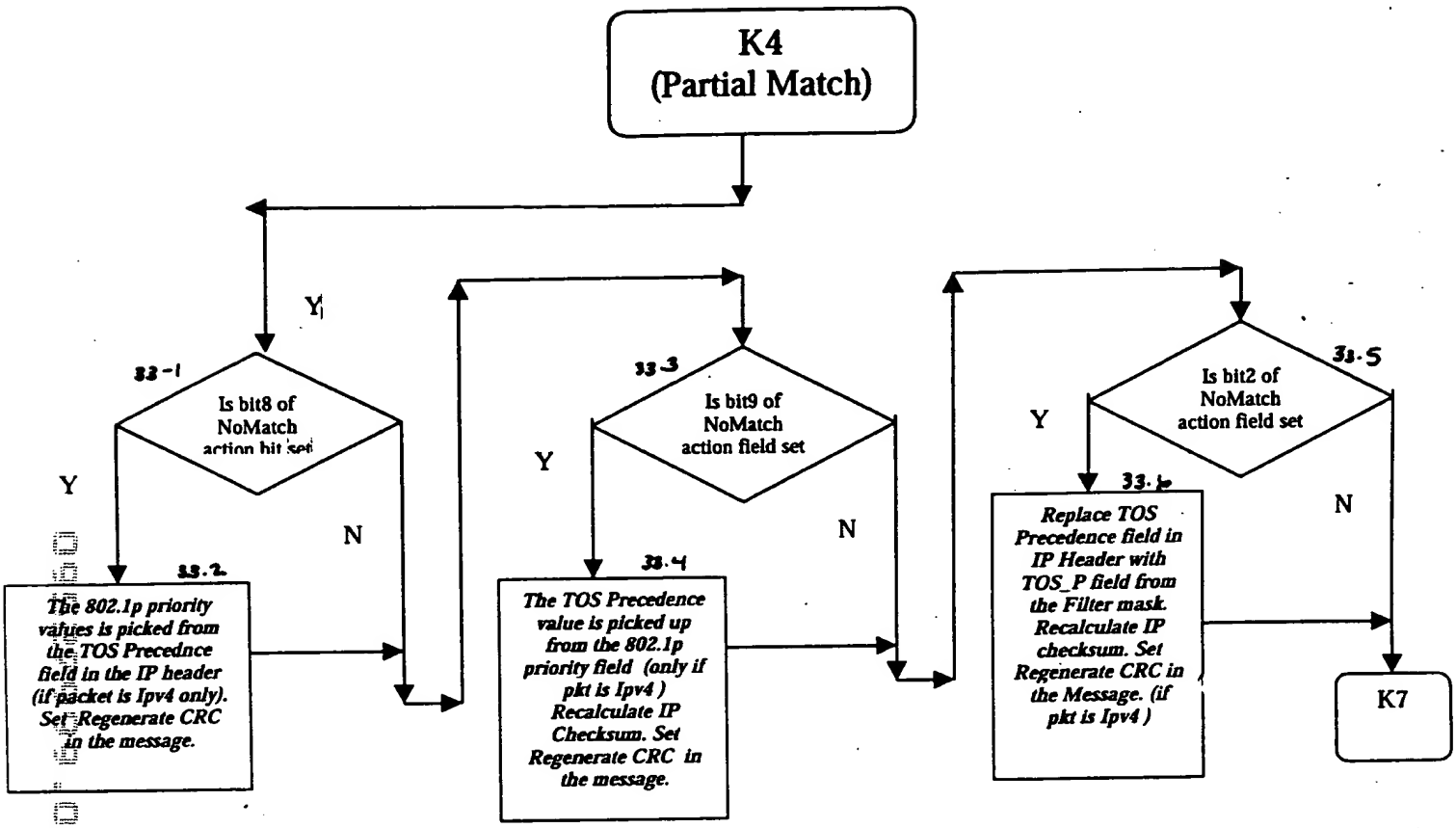

K4
(Partial Match)
Y
33-1
Is bit8 of NoMatch action bit set
Y
N
33.2
The 802.1p priority values is picked from the TOS Precednce field in the IP header (if packet is Ipv4 only). Set Regenerate CRC in the message.
33.3
Is bit9 of NoMatch action field set
Y
N
33.4
The TOS Precedence value is picked up from the 802.1p priority field (only if pkt is Ipv4) Recalculate IP Checksum. Set Regenerate CRC in the message.
33.5
Is bit2 of NoMatch action field set
Y
N
33.6
Replace TOS Precedence field in IP Header with TOS_P field from the Filter mask. Recalculate IP checksum. Set Regenerate CRC in the Message. (if pkt is Ipv4)
K7

FIGURE 33

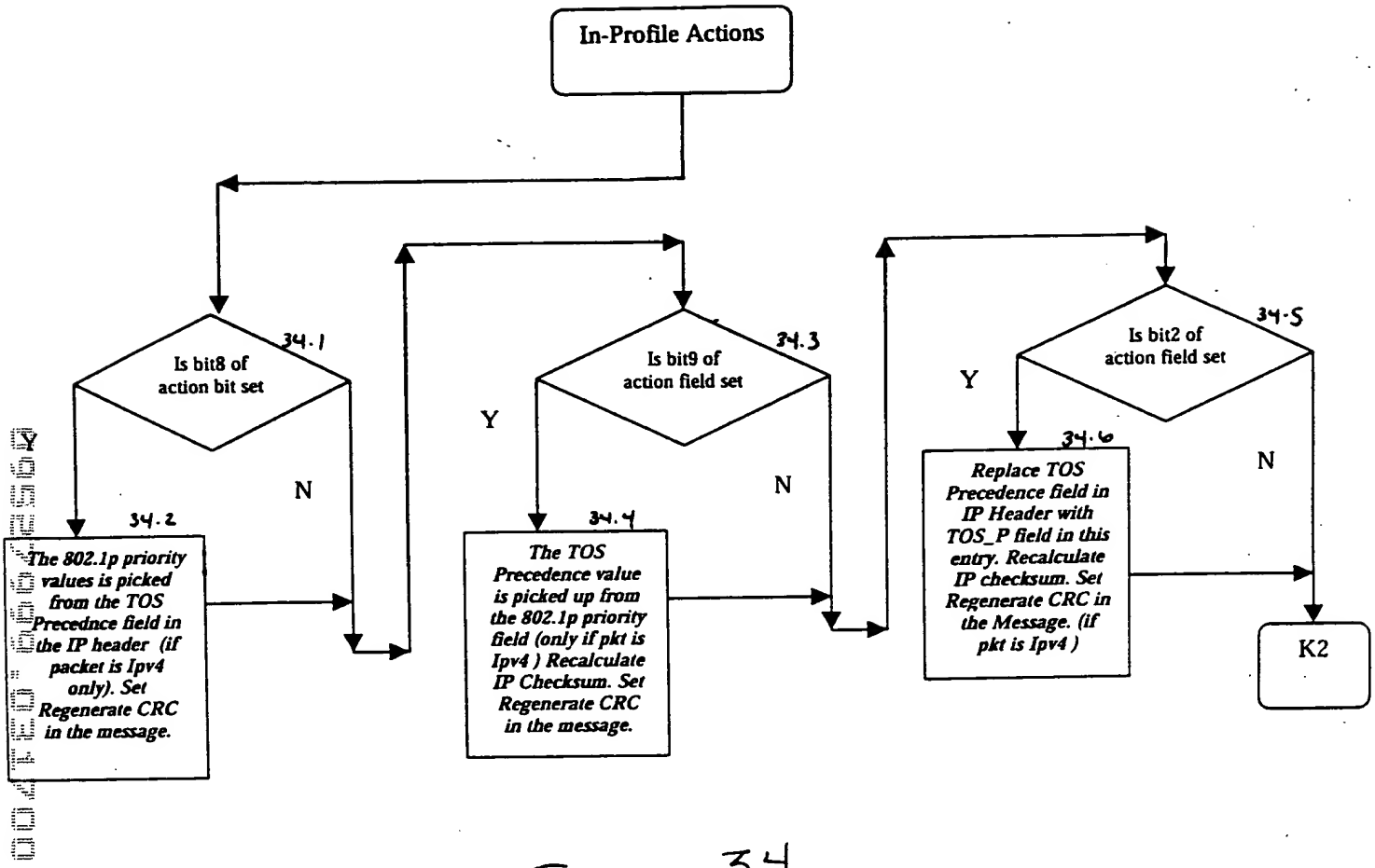

In-Profile Actions
Is bit8 of action bit set
34.1
Y
N
34.2
The 802.1p priority values is picked from the TOS Precednce field in the IP header (if packet is Ipv4 only). Set Regenerate CRC in the message.
Is bit9 of action field set
34.3
Y
N
34.4
The TOS Precedence value is picked up from the 802.1p priority field (only if pkt is Ipv4) Recalculate IP Checksum. Set Regenerate CRC in the message.
Is bit2 of action field set
34.5
Y
N
34.6
Replace TOS Precedence field in IP Header with TOS_P field in this entry. Recalculate IP checksum. Set Regenerate CRC in the Message. (if pkt is Ipv4)
K2

FIGURE 34

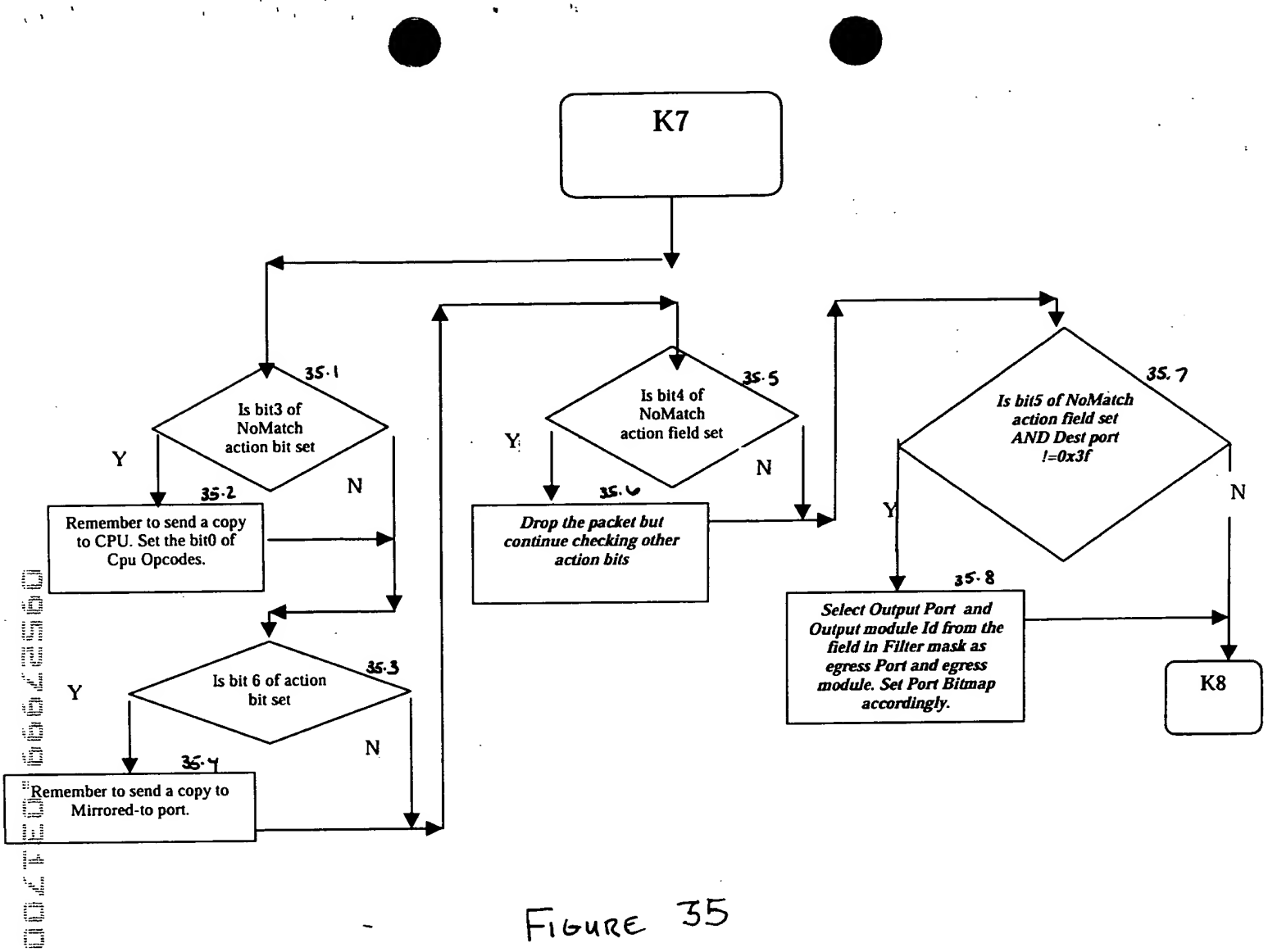

K7
35.1
Is bit3 of NoMatch action bit set
Y
N
35.2
Remember to send a copy to CPU. Set the bit0 of Cpu Opcodes.
35.3
Is bit 6 of action bit set
Y
N
35.4
Remember to send a copy to Mirrored-to port.
35.5
Is bit4 of NoMatch action field set
Y
N
35.6
Drop the packet but continue checking other action bits
35.7
Is bit5 of NoMatch action field set AND Dest port !=0x3f
Y
N
35.8
Select Output Port and Output module Id from the field in Filter mask as egress Port and egress module. Set Port Bitmap accordingly.
K8

FIGURE 35

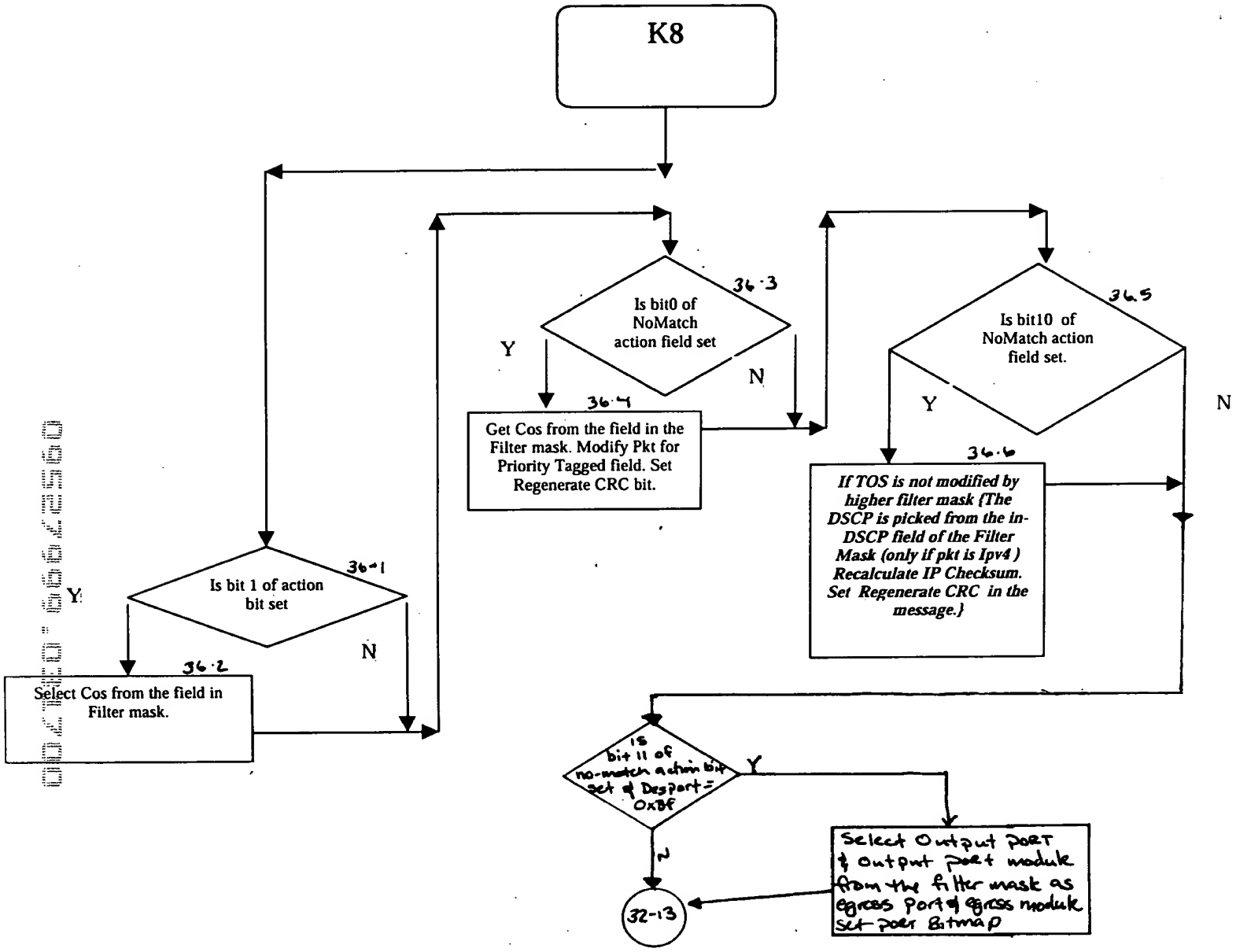

K8
Is bit 1 of action bit set
36-1
Y
N
Select Cos from the field in Filter mask.
36-2
Is bit0 of NoMatch action field set
36-3
Y
N
Get Cos from the field in the Filter mask. Modify Pkt for Priority Tagged field. Set Regenerate CRC bit.
36-4
Is bit10 of NoMatch action field set.
36-5
Y
N
If TOS is not modified by higher filter mask {The DSCP is picked from the in-DSCP field of the Filter Mask (only if pkt is Ipv4) Recalculate IP Checksum. Set Regenerate CRC in the message.}
36-6
Is bit 11 of no-match action bit set & Desport = 0x8f
Y
N
Select Output port & output port module from the filter mask as egress port & egress module set-port Bitmap
32-13

FIGURE 36

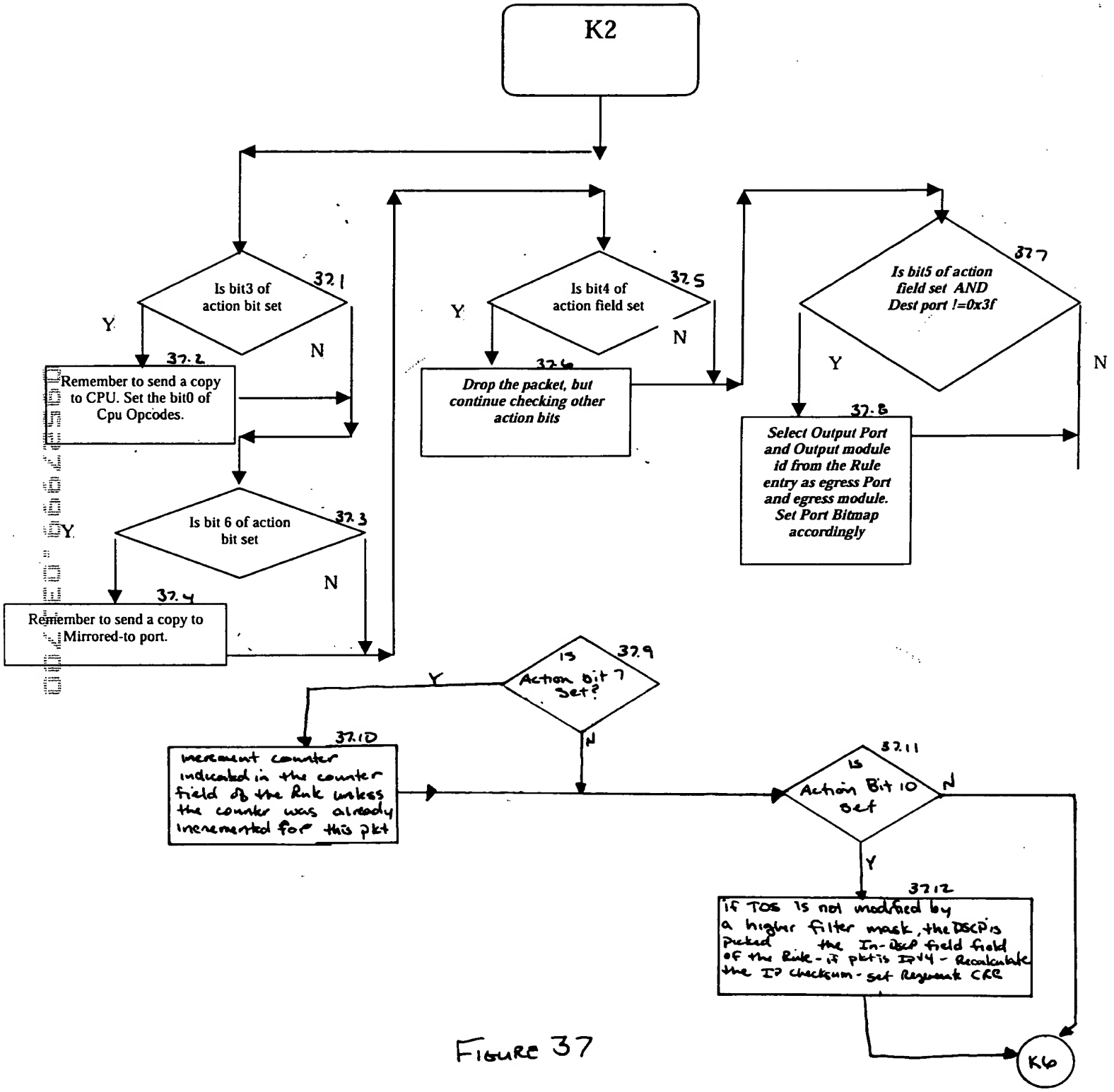

K2
Is bit3 of action bit set
37.1
Y
N
37.2
Remember to send a copy to CPU. Set the bit0 of Cpu Opcodes.
Is bit 6 of action bit set
37.3
Y
N
37.4
Remember to send a copy to Mirrored-to port.
Is bit4 of action field set
37.5
Y
N
37.6
Drop the packet, but continue checking other action bits
Is bit5 of action field set AND Dest port !=0x3f
37.7
Y
N
37.8
Select Output Port and Output module id from the Rule entry as egress Port and egress module. Set Port Bitmap accordingly
Is Action bit 7 Set?
37.9
Y
N
37.10
increment counter indicated in the counter field of the Rule unless the counter was already incremented for this pkt
Is Action Bit 10 Set
37.11
N
Y
37.12
If TOS is not modified by a higher filter mask, the DSCP is picked the In-DSCP field field of the Rule - if pkt is IPv4 - Recalculate the IP checksum - set Regenerate CRC
K6

FIGURE 37

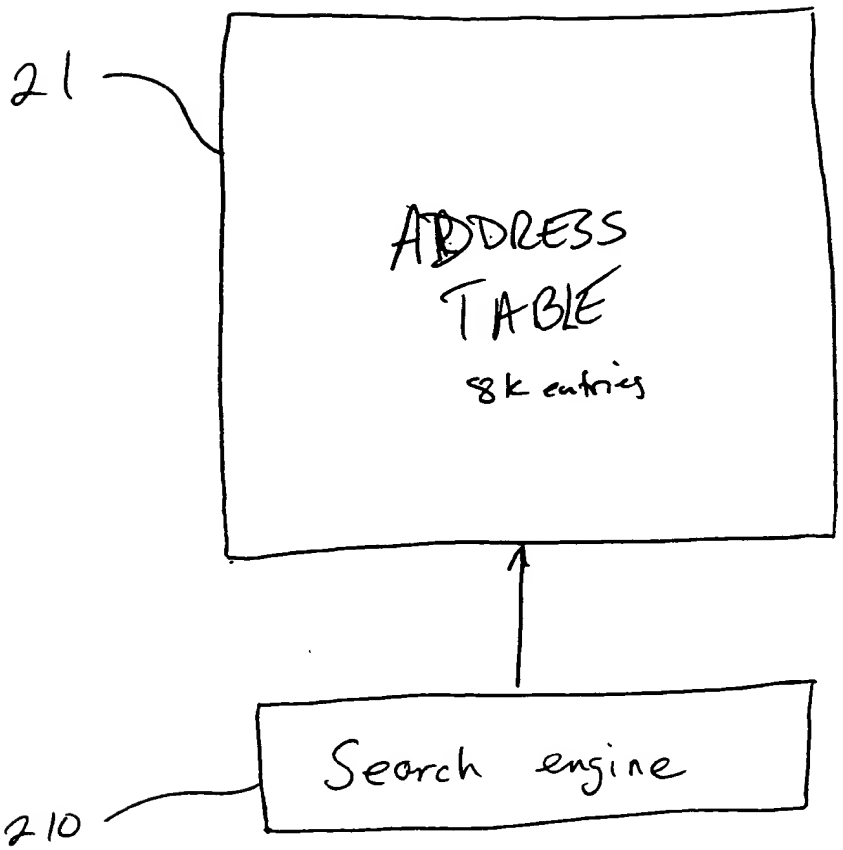


Fig 38

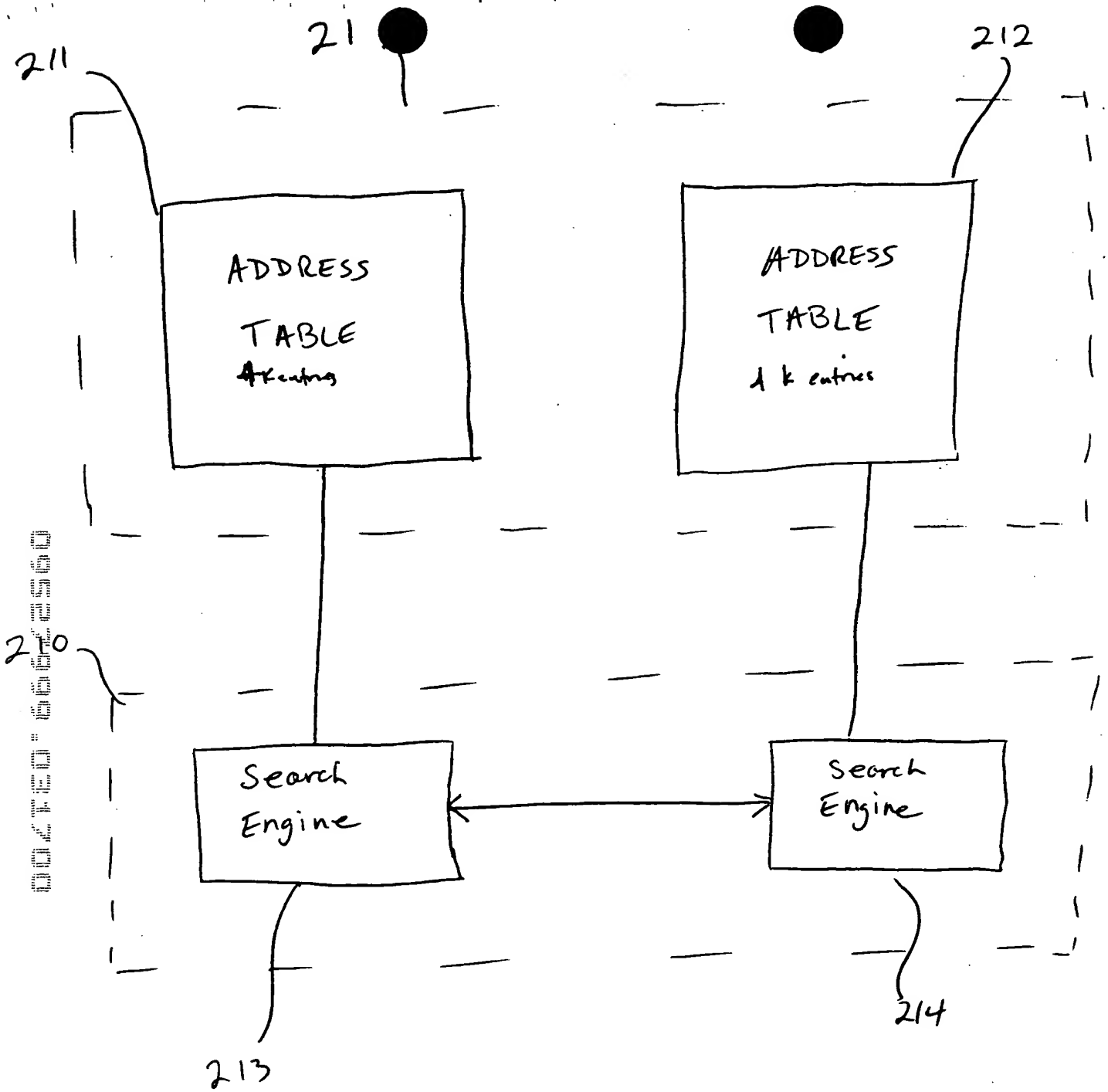

21
211
212
ADDRESS TABLE
4k entries
ADDRESS TABLE
1 k entries
210
Search Engine
Search Engine
213
214

Fig. 39

Figure 40a

21

address	entry
31	AF
30	AE
29	AD
28	AC
27	AB
26	AA
25	Z
24	Y
23	X
22	W
21	V
20	U
19	T
18	S
17	R
16	Q
15	P
14	O
13	N
12	M
11	L
10	K
9	J
8	I
7	H
6	G
5	F
4	E
3	D
2	C
1	B
0	A

211

address	entry
30	AE
28	AC
26	AA
24	Y
22	W
20	U
18	S
16	Q
14	O
12	M
10	K
8	I
6	G
4	E
2	C
0	A

212

address	entry
31	AF
29	AD
27	AB
25	Z
23	X
21	V
19	T
17	R
15	P
13	N
11	L
9	J
7	H
5	F
3	D
1	B

21

Fig 40b

Figure 4a

21

address	entry
31	NN
30	MM
29	LL
28	KK
27	JJ
26	GH
25	CF
24	CC
23	BE
22	BD
21	BC
20	BA
19	AC
18	AB
17	AA
16	Y
15	X
14	V
13	T
12	S
11	R
10	Q
9	N
8	M
7	L
6	K
5	J
4	G
3	E
2	D
1	C
0	B

211

address	entry
30	MM
28	KK
26	GH
24	CC
22	BD
20	BA
18	AB
16	Y
14	V
12	S
10	Q
8	M
6	K
4	G
2	D
0	B

212

address	entry
31	NN
29	LL
27	JJ
25	CF
23	BE
21	BC
19	AC
17	AA
15	X
13	T
11	R
9	N
7	L
5	J
3	E
1	C

Fig 4a

DOCKET NO. 50277-2050

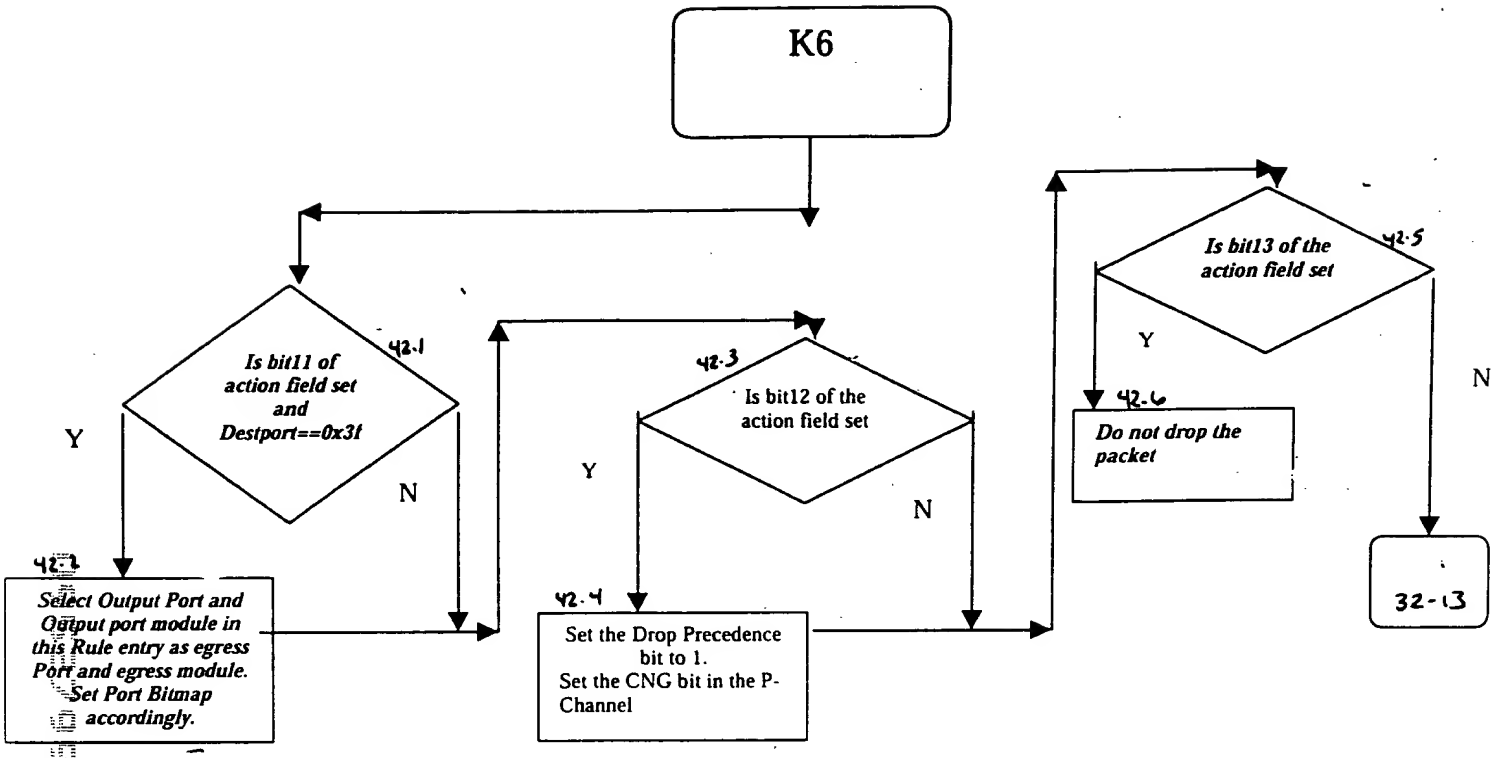

K6
Is bit11 of action field set and Destport==0x3f
42.1
Y
N
42.2
Select Output Port and Output port module in this Rule entry as egress Port and egress module. Set Port Bitmap accordingly.
Is bit12 of the action field set
42.3
Y
N
42.4
Set the Drop Precedence bit to 1.
Set the CNG bit in the P-Channel
Is bit13 of the action field set
42.5
Y
N
42.6
Do not drop the packet
32-13

Figure 42

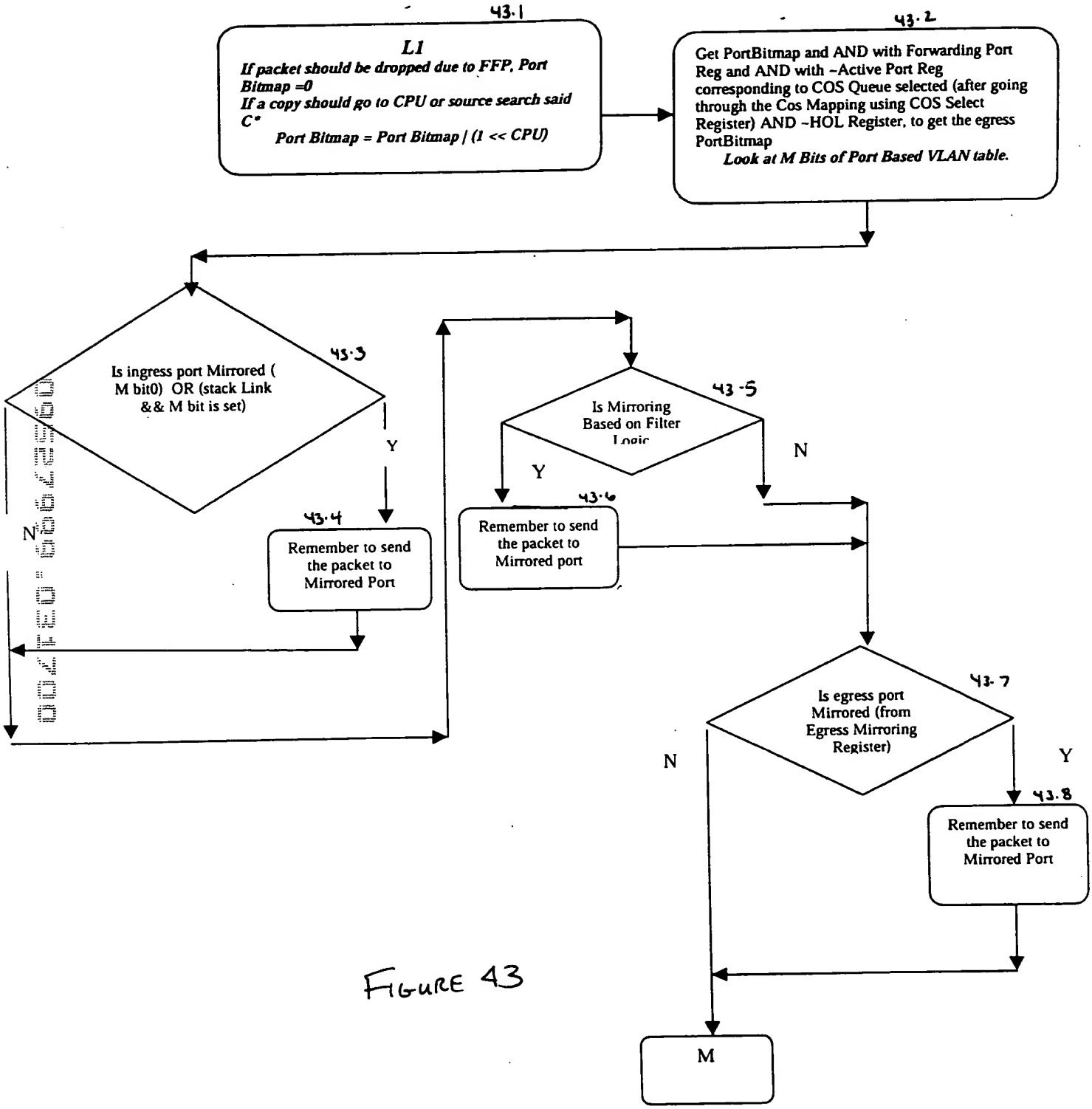

43.1
L1
If packet should be dropped due to FFP, Port Bitmap =0
If a copy should go to CPU or source search said C*
Port Bitmap = Port Bitmap | (1 << CPU)
43.2
Get PortBitmap and AND with Forwarding Port Reg and AND with ~Active Port Reg corresponding to COS Queue selected (after going through the Cos Mapping using COS Select Register) AND ~HOL Register, to get the egress PortBitmap
Look at M Bits of Port Based VLAN table.
Is ingress port Mirrored (M bit0) OR (stack Link && M bit is set)
43.3
Y
N
43.4
Remember to send the packet to Mirrored Port
Is Mirroring Based on Filter Logic
43.5
Y
N
43.6
Remember to send the packet to Mirrored port
Is egress port Mirrored (from Egress Mirroring Register)
43.7
N
Y
43.8
Remember to send the packet to Mirrored Port
M

FIGURE 43

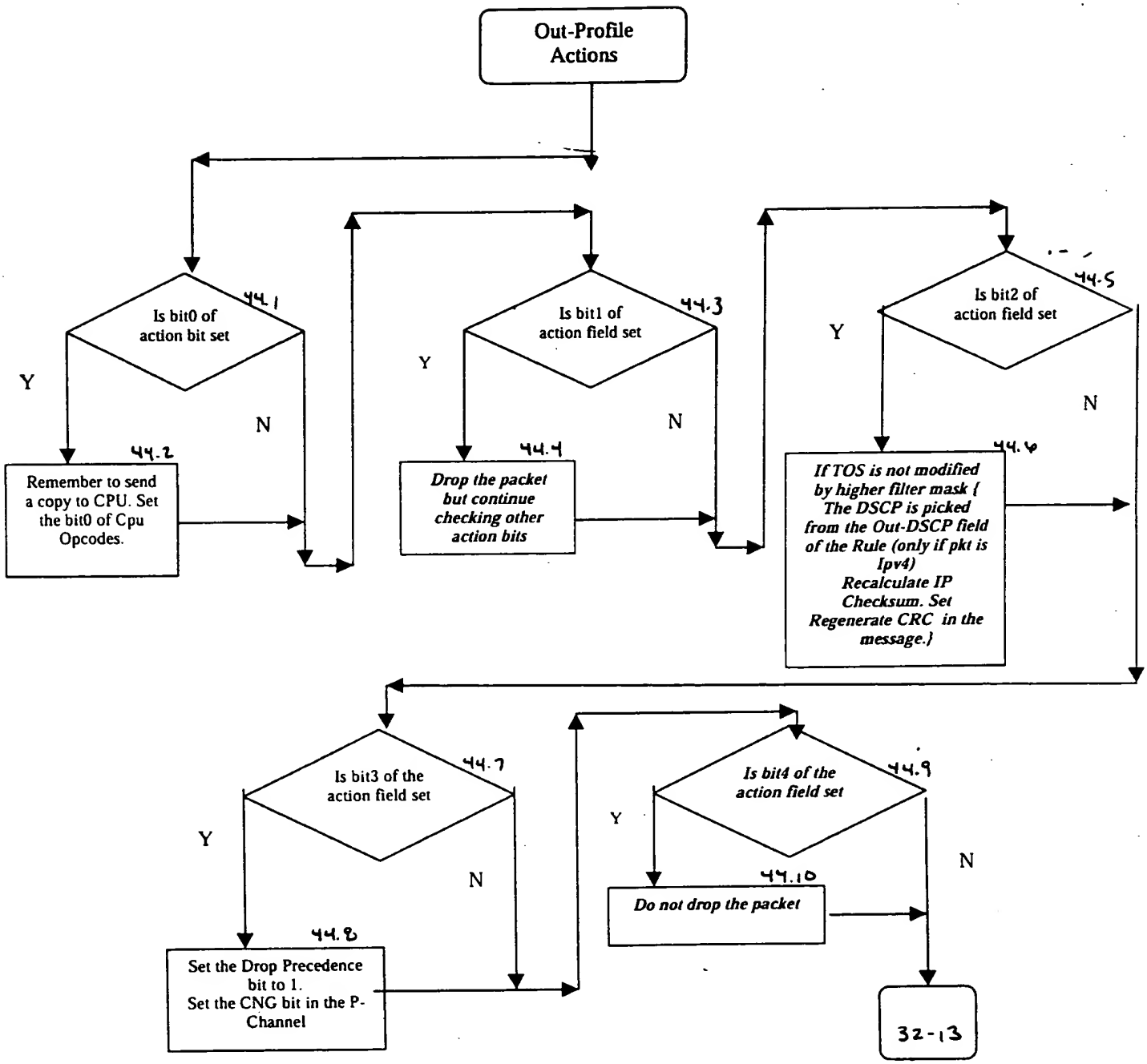

Out-Profile Actions
Is bit0 of action bit set
44.1
Y
N
Remember to send a copy to CPU. Set the bit0 of Cpu Opcodes.
44.2
Is bit1 of action field set
44.3
Y
N
Drop the packet but continue checking other action bits
44.4
Is bit2 of action field set
44.5
Y
N
If TOS is not modified by higher filter mask { The DSCP is picked from the Out-DSCP field of the Rule (only if pkt is Ipv4) Recalculate IP Checksum. Set Regenerate CRC in the message.}
44.6
Is bit3 of the action field set
44.7
Y
N
Set the Drop Precedence bit to 1. Set the CNG bit in the P-Channel
44.8
Is bit4 of the action field set
44.9
Y
N
Do not drop the packet
44.10
32-13

FIGURE 44

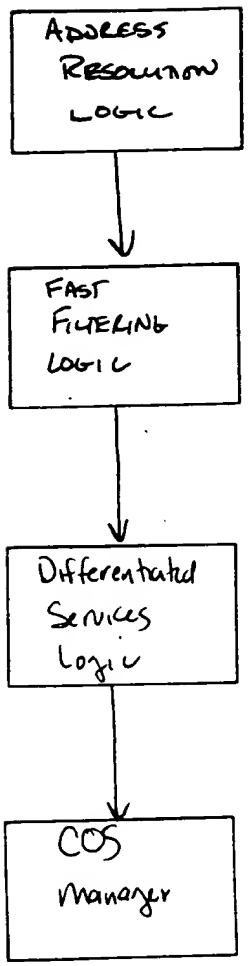

Address Resolution Logic
Fast Filtering Logic
Differentiated Services Logic
COS Manager

FIGURE 45

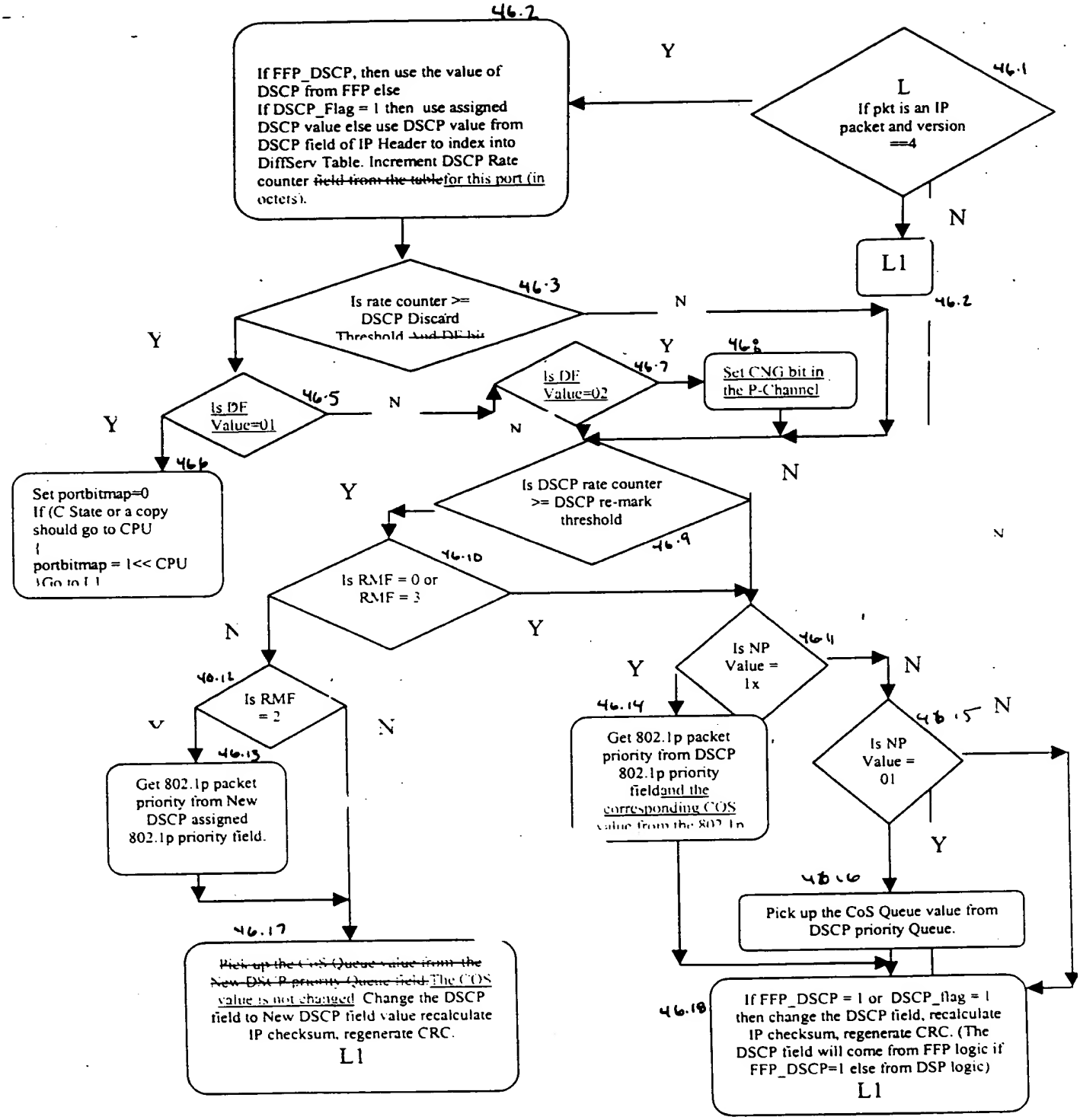

L
If pkt is an IP packet and version ==4
46.1
Y
N
L1
If FFP_DSCP, then use the value of DSCP from FFP else
If DSCP_Flag = 1 then use assigned DSCP value else use DSCP value from DSCP field of IP Header to index into DiffServ Table. Increment DSCP Rate counter ~~field from the table~~for this port (in octets).
46.2
Is rate counter >= DSCP Discard Threshold ~~And DE bit~~
46.3
Y
N
Is DE Value=01
46.5
Y
N
Is DE Value=02
46.7
Y
N
Set CNG bit in the P-Channel
46.8
Set portbitmap=0
If (C State or a copy should go to CPU
{
portbitmap = 1<< CPU
}Go to L1
46.6
Is DSCP rate counter >= DSCP re-mark threshold
46.9
Y
N
Is RMF = 0 or RMF = 3
46.10
N
Y
Is RMF = 2
46.12
Y
N
Get 802.1p packet priority from New DSCP assigned 802.1p priority field.
46.13
Is NP Value = 1x
46.11
Y
N
Get 802.1p packet priority from DSCP 802.1p priority fieldand the corresponding COS value from the 802.1p
46.14
Is NP Value = 01
46.15
Y
N
Pick up the CoS Queue value from DSCP priority Queue.
46.16
~~Pick up the CoS Queue value from the New DSCP priority Queue field.~~ The COS value is not changed Change the DSCP field to New DSCP field value recalculate IP checksum, regenerate CRC.
L1
46.17
If FFP_DSCP = 1 or DSCP_flag = 1 then change the DSCP field, recalculate IP checksum, regenerate CRC. (The DSCP field will come from FFP logic if FFP_DSCP=1 else from DSP logic)
L1
46.18

FIGURE 46

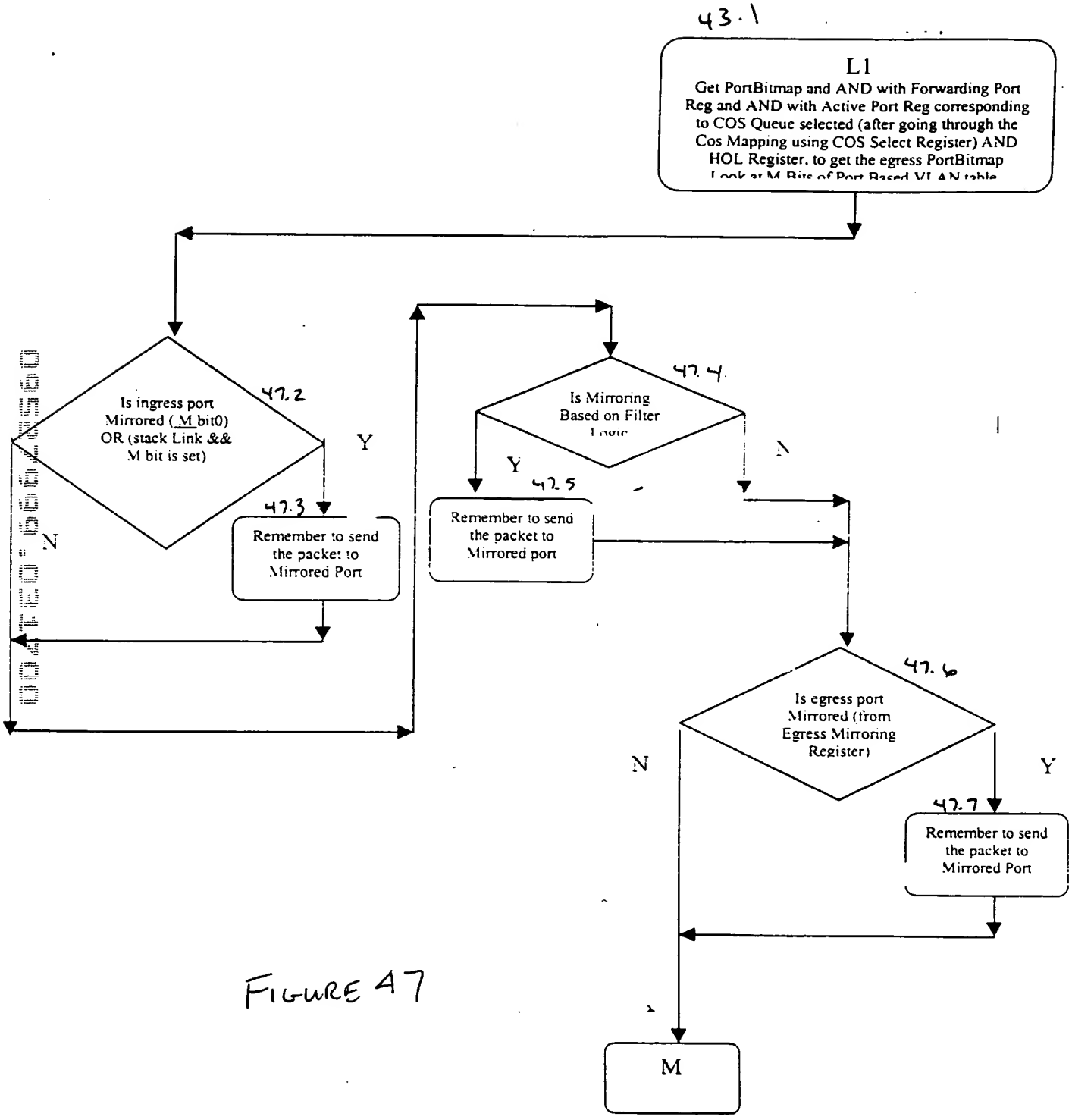

43.1
L1
Get PortBitmap and AND with Forwarding Port Reg and AND with Active Port Reg corresponding to COS Queue selected (after going through the Cos Mapping using COS Select Register) AND HOL Register, to get the egress PortBitmap
Look at M Bits of Port Based VLAN table
47.2
Is ingress port Mirrored (M bit0) OR (stack Link && M bit is set)
Y
N
47.3
Remember to send the packet to Mirrored Port
47.4
Is Mirroring Based on Filter Logic
Y
N
47.5
Remember to send the packet to Mirrored port
47.6
Is egress port Mirrored (from Egress Mirroring Register)
N
Y
47.7
Remember to send the packet to Mirrored Port
M

FIGURE 47